APPENDIX B – Pertinent Correspondence

This page intentionally left blank

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
P.O. BOX 4970
JACKSONVILLE, FLORIDA 32232-0019

REPLY TO
ATTENTION OF

Planning and Policy Division
Environmental Branch

APR 16 2014

Mr. David Bernhart
NOAA Fisheries Service
Southeast Regional Office
263 13th Avenue South
Saint Petersburg, FL 33701

Dear Mr. Bernhart:

Pursuant to Section 7(a) of the Endangered Species Act, please find enclosed the Biological Assessment for the maintenance dredging and bulkhead replacement at U.S. Coast Guard Base Miami Beach, addressing the concerns of the threatened and endangered species under the purview of the National Marine Fisheries Service (NMFS). Listed species which may occur in the vicinity of the proposed work and are under the jurisdiction of the NMFS are: green turtle (*Chelonia mydas*), loggerhead turtle (*Caretta caretta*), Kemp's ridley turtle (*Lepidochelys kempii*), Hawksbill sea turtle (*Eretmochelys imbricata*), leatherback turtle (*Dermochelys coriacea*), smalltooth sawfish (*Pristis pectinata*), elkhorn coral (*Acropora palmata*), staghorn coral (*Acropora cervicornis*) and six proposed coral species. Based on the enclosed Biological Assessment, the USCG has determined that the proposed action may affect, but is not likely to adversely affect the species identified in the Biological Assessment, is not likely to modify designate critical habitat and is not likely to jeopardize the continued existence of proposed species. The USCG requests your written concurrence on this determination.

The Corps is serving as the USCG's agent for this action, and will also adopt the results of the consultation for issuance of the Section 10/Section 404 permits from Corps to USCG for the required work. If you have any questions or need further information, please contact Mrs. Terri Jordan-Sellers at 904-232-1701 or by email: Terri.Jordan-Sellers@usace.army.mil.

Sincerely,

Eric P. Summa
Chief, Environmental Branch

Enclosure

This page intentionally left blank

CONSULTATION UNDER SECTION 7 OF THE ENDANGERED SPECIES ACT- MAINTENANCE DREDGING CG HUDSON SLIP AND REPLACEMENT OF BULKHEADS AT U. S. COAST GUARD BASE MIAMI BEACH WITH NATIONAL MARINE FISHERIES SERVICE

The U. S. Coast Guard is completing a draft Environmental Assessment (EA) for the maintenance dredging of the Coast Guard Cutter *Hudson's* slip and replacement of bulkheads at Coast Guard Base Miami Beach.

Project Location

The US Coast Guard Station, Miami Beach is located in Miami-Dade County on a man-made island, on the south side of Melloy Channel (Figure 1 and Figure 2) and north of the main entrance to the Port of Miami, Government Cut. Miami-Dade County is located on the southeast coast of Florida between Fort Lauderdale and the Florida Keys. The County is bounded to the north by Broward County and to the south by Monroe County.

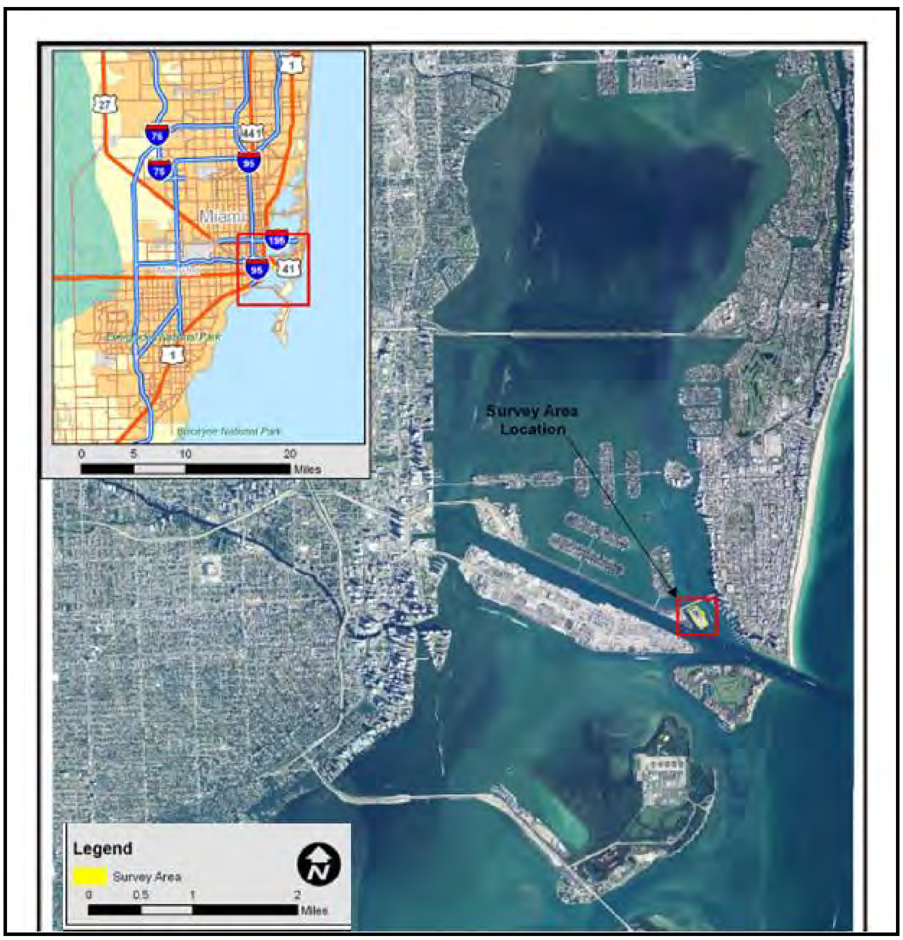


Figure 1 - Location of USCG Base Miami Beach

Figure 2 - USCG Base Miami Beach looking east

Description of the Proposed Action

The Coast Guard proposes to maintenance dredge up to 5,000 cubic yards of material from the CGC Hudson's slip and replace bulkheads on the eastern and southern sides of the Coast Guard Base Miami Beach. The Hudson is berthed on the east side of CGB Miami Beach (Figure 3). The berth is 300 feet long by 85 feet wide. The site was last maintained in early 1995. Dredging will be done with either a mechanical dredge (clamshell or backhoe) or a small cutterhead dredge with dredged material disposal with a bottom dump scow in the Miami Ocean Dredged Material Disposal Site.

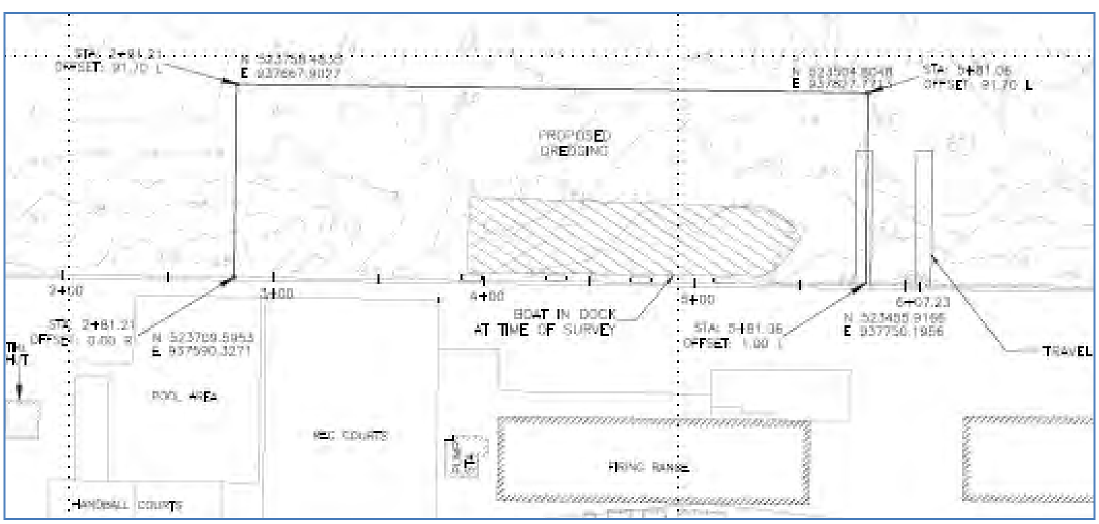


Figure 3 - Schematic of the CGC Hudson's slip

The current bulkhead is steel sheet pile with a concrete cap, which retains the soil backfill around the entire island. The island was constructed in the 1940's and the east and north bulkheads are original. Additional areas were built out in the 1960's and some sections were replaced in the 1980's.

The Coast Guard uses areas along the bulkhead to moor and support Coast Guard Cutters. Sections of bulkhead have reached the end of their service life such that vehicle loading is restricted on the shore side which impacts the operations of the Cutters. Approximately 1,261 linear feet of bulkhead along the east and south section of the island is scheduled for replacement (Figure 4). The scope of this work will be the replacement of two "zones", or lengths of bulkhead separated by era and type of construction. This work will be completed through a commercial contract administered by Coast Guard Civil Engineering Unit Miami.

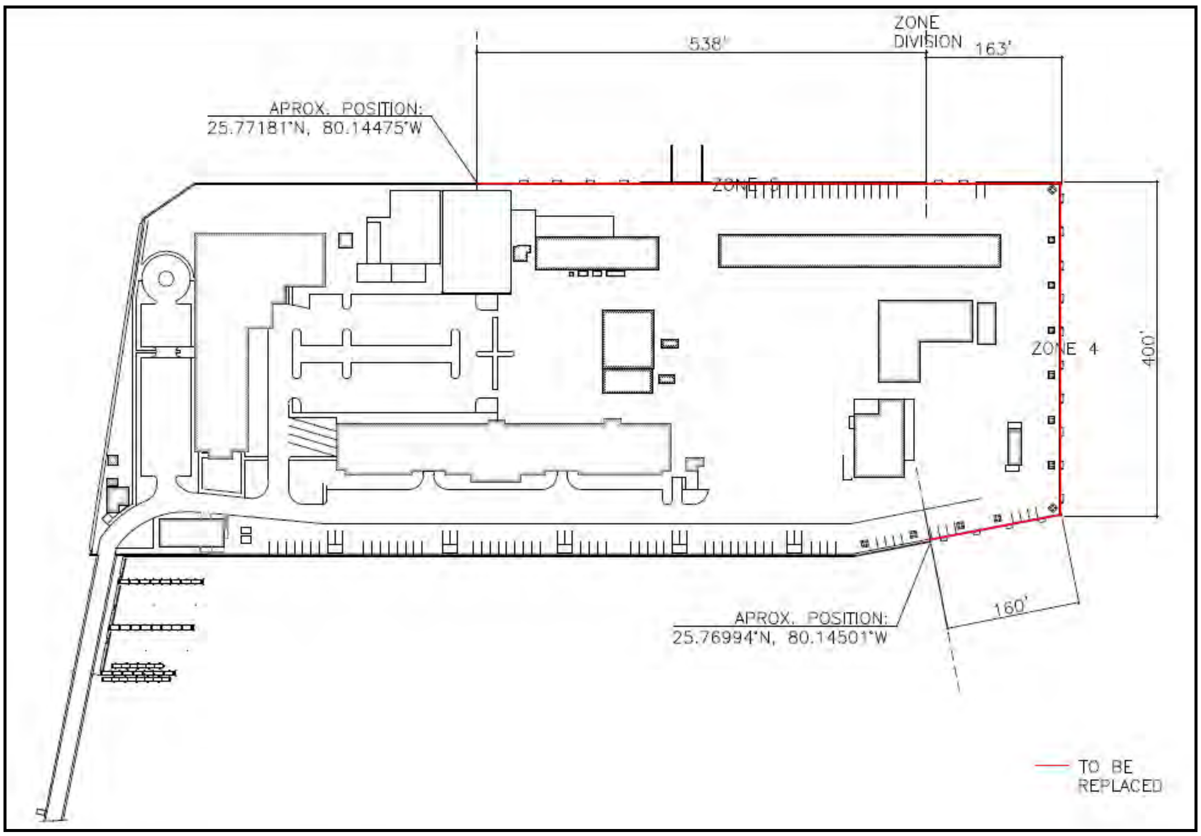


Figure 4 - Schematic of eastern and southern bulkheads needing replacement

Installation of the new bulkhead includes driving new pilings into the seafloor. A pile driving template will be mounted to the crane barge. This allows the crane barge to control the alignment of the piles as they are driven. Once the crane barge is properly aligned, the piles will likely be driven to the appropriate depth using a vibratory hammer similar to that used in other bulkhead installations such as NAVSTA Mayport (Figure 5). An impact hammer will be a contingency employed only if vibratory methods are inadequate. Pile driving produces underwater noise during construction which will be addressed in the affects discussion later in this assessment.

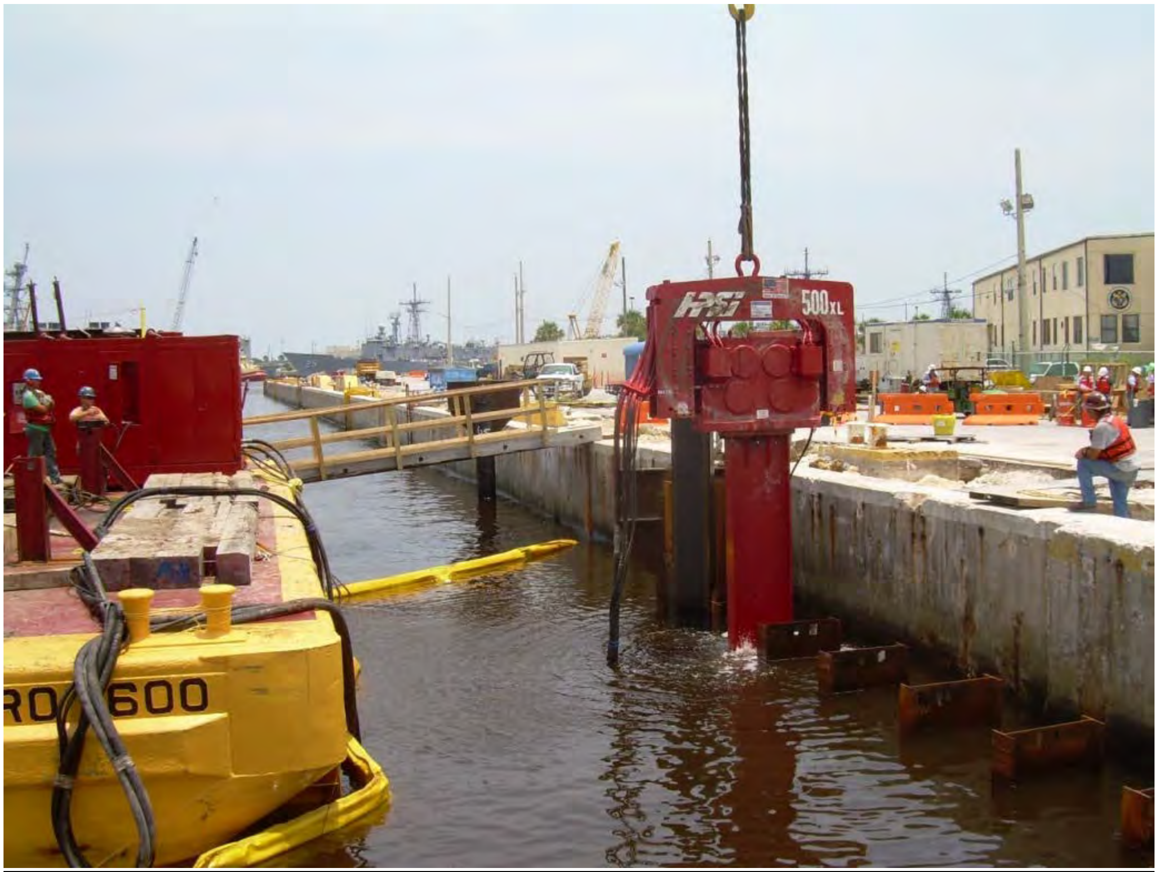


Figure 5. Vibratory Installation of Sheet Piles at NAVSTA Mayport

At present, underwater ambient noise in the project area is likely to be dominated by sounds from normal port operations, which can exceed 180 dB re 1 μPa close to the source and will continue during and after the proposed action. These sounds are non-impulsive and intermittent, occurring sporadically during normal port activities. Noise from vibratory pile driving associated with the proposed action is unlikely to alter the existing ambient noise within the project area because of its relatively low source level (approximately 157 dB re 1 μPa rms at 10 m) and non-impulsive nature. Noise from impact pile driving has higher source levels (approximately 186 dB re 1 μPa at 10m) and is impulsive in nature, with a fast rise time and multiple short-duration (50–100 millisecond; Illingworth & Rodkin 2001) events.

Protected Species Under NMFS Jurisdiction Included in this Assessment

The following endangered (E) and threatened (T) and Proposed (P) species under the jurisdiction of NMFS may occur in or near the action area:

Common Name	Scientific Name	Status
Sea Turtles		
Loggerhead sea turtle	*Caretta caretta*	E/T
Hawksbill sea turtle	*Eretmochelys imbricate*	E
Leatherback sea turtle	*Dermochelys coriacea*	E
Kemp's ridley sea turtle	*Lepidochelys kempii*	E
Green sea turtle	*Chelonia mydas*	E/T
Fish		
Smalltooth sawfish	*Pristis pectinata*	E
Plants		
Johnson's seagrass	*Halophila johnsonii*	T
Invertebrates (listed and proposed)		
Elkhorn coral	*Acropora palmata*	T (PE)
Staghorn coral	*Acropora cervicornis*	T (PE)
Boulder star coral	*Montastraea annularis*	PE
Boulder star coral	*Montastraea faveolata*	PE
Mountainous star coral	*Montastraea franksi*	PE
Rough cactus coral	*Mycetophyllia ferox*	PE
Pillar coral	*Dendrogyra cylindrus*	PT
Elliptical Star Coral	*Dichocoenia stokesii*	PT
Lamarck's sheet coral	*Agaricia lamarcki*	PT

Critical Habitat

ESA-designated critical habitat for Johnson's seagrass occurs within the action area.

Affect Determination

The Coast Guard has reviewed the biological, status, threats and distribution information presented in this assessment and believes that the following species will be in or near the action area and thus may be affected by the proposed project: four sea turtle species, smalltooth sawfish and the proposed coral species. Additionally, the project takes place in Johnson's seagrass critical habitat.

Sea Turtles

Miami-Dade County is within the normal nesting range of three species of sea turtles: the threatened loggerhead (*Caretta caretta*), the endangered green turtle (*Chelonia mydas*), and the endangered leatherback (*Dermochelys coriacea*). The endangered hawksbill sea turtle (*Eretmochelys imbricata)* has also been recorded nesting in the County on rare occurrences. The majority of sea turtle nesting activity in Miami-Dade

County occurs during the summer months of June, July and August, with nesting activity occurring as early as March and as late as September. The waters and habitats inshore of Miami-Dade County in Biscayne Bay are also used for foraging and shelter for the three species listed above and possibly the hawksbill turtle and the Kemp's ridley turtle (*Lepidochelys kempii*) (USACE 2000).

Between 2004-2010, 155 stranded sea turtles have been reported within an area five miles north and five miles south of the Miami Beach Coast Guard Base. 61 loggerhead turtles, 74 green turtles, fourteen hawksbill turtles, three leatherback sea turtles , one Kemp's ridley and two unidentified species. (A. Foley, FWRI, pers com, January 2014). Specific location information, i.e., latitude/longitude, for 2011 through 2013 have not yet been entered into the FWC database, so it is unknown if any strandings for those years were associated with the project area.

Fish - Smalltooth Sawfish

The smalltooth sawfish (*Pristis pectinata*) has a circumtropical distribution and has been reported from shallow coastal and estuarine habitats. In U.S. waters, smalltooth sawfish, *P. pectinata* historically occurred from North Carolina south through the Gulf of Mexico, where it was sympatric with the largetooth sawfish *P. perotteti* (west and south of Port Arthur, TX) (Adams and Wilson, 1995). Individuals have also historically been reported to migrate northward along the Atlantic seaboard in the warmer months. It also was an occasional visitor to waters as far north as New York.

Smalltooth sawfish, *P. pectinata,* were once common in Florida as detailed by the Final Smalltooth Sawfish Recovery Plan (NMFS 2009a) and are very rarely reported in southeast Florida. Their core range extends along the Everglades coast from the Ten Thousand Islands to Florida Bay, with moderate occurrence in the Florida Keys and at the mouth of the Caloosahatchee River. Outside of these areas, sawfish are rarely encountered and appear to be relatively rare (Simpfendorfer 2006). It does not appear to be a coincidence that the core range of smalltooth sawfish corresponds to the section of Florida with the smallest amount of coastal habitat modification. USCG requested sighting information from the NMFS smalltooth sawfish sighting database in January 2014 for the "area in and around the Miami Beach Coast Guard Station." In an email response dated January 7, 2014 NMFS staff responded to the data request with Figure 6 attached showing the sightings from 1999-2013. It appears from the graphic that the closest sightings were in the Miami River and south of Bayside Marina in 2009 and 2010.

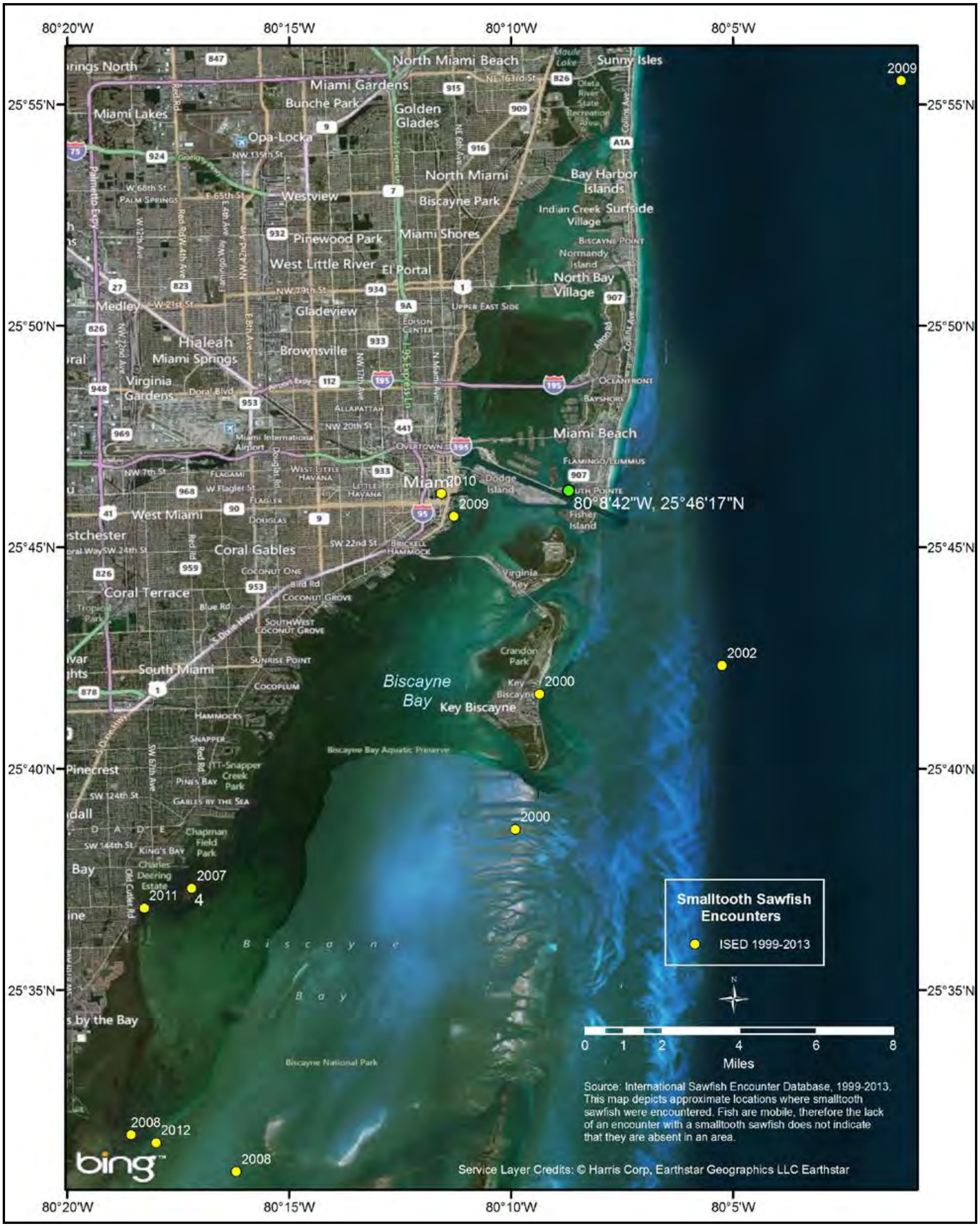


Figure 6 - Location of Sawfish Encounters in Miami Dade County

Habitat use by sawfish appears to be divided by animal size. Small sawfish (0-79 inches/0-200 cm) use shallow water areas as nursery areas often dominated by red mangrove habitats. The mangrove prop roots help serve as shelter against predation (NMFS 2009a and Simpfendorfer 2006). There is limited data available on habitat usage for large juvenile sawfish (>79 inches/201 cm). One tagged individual was recorded in water depths of less than 17 feet for 120-days (NMFS, 2006). Simpfendorfer found that a large percentage of animals greater than 300 cm (3 meters) in size were found in deeper water. Adult smalltooth sawfish use shallow coastal waters to deep shelf waters of up to 400 feet (NMFS 2009a). They may use navigation channels as a transit corridor between the shallow coastal and deeper water habitats.

NMFS released the final recovery plan for the smalltooth sawfish in January 2009 (NMFS, 2009a), and designated critical habitat for the species in September 2009 (74 FR 45353). There is no designated critical habitat for smalltooth sawfish in the project area.

<u>Plants - Johnson's Seagrass</u>

A detailed review of the biology and status of Johnson’s seagrass is located in numerous documents including a status review, recovery plan and five year review published by NMFS since the species was listed in 1998 and is incorporated by reference. *Halophila johnsonii* has the most limited geographic ranges of all seagrass species. It is known to occur only from 21.5 km north of Sebastian Inlet (i.e., near Palm Bay in Brevard County) south to northern Biscayne Bay (i.e., North Miami) on the east coast of Florida (Kenworthy 1997; Virnstein and Hall 2009). Although NMFS has listed *H. johnsonii* as a threatened species under Section 4 of the ESA, it has not promulgated a 4d rule under the Act, and as a result, there is no prohibition on take the *H. johnsonii*.

<u>Critical Habitat</u>

The northern and southern ranges of Johnson's seagrass are defined as Sebastian Inlet and central Biscayne Bay, respectively. These limits to the species' range have been designated as critical habitat for Johnson’s seagrass. Within its range, Johnson’s seagrass critical habitat designations have been designated for 10 areas: a portion of the Indian River Lagoon, north of the Sebastian Inlet Channel; a portion of the Indian River Lagoon, south of the Sebastian Inlet Channel; a portion of the Indian River Lagoon near the Fort Pierce Inlet; a portion of the Indian River Lagoon, north of the St. Lucie Inlet; a portion of Hobe Sound; a site on the south side of Jupiter Inlet; a site in central Lake Worth Lagoon; a site in Lake Worth Lagoon, Boynton Beach; a site in Lake Wyman, Boca Raton; and a portion of Biscayne Bay. The project is located in designated critical habitat for Johnson’s seagrass in Biscayne Bay (NMFS, 2000) (Figure 7).

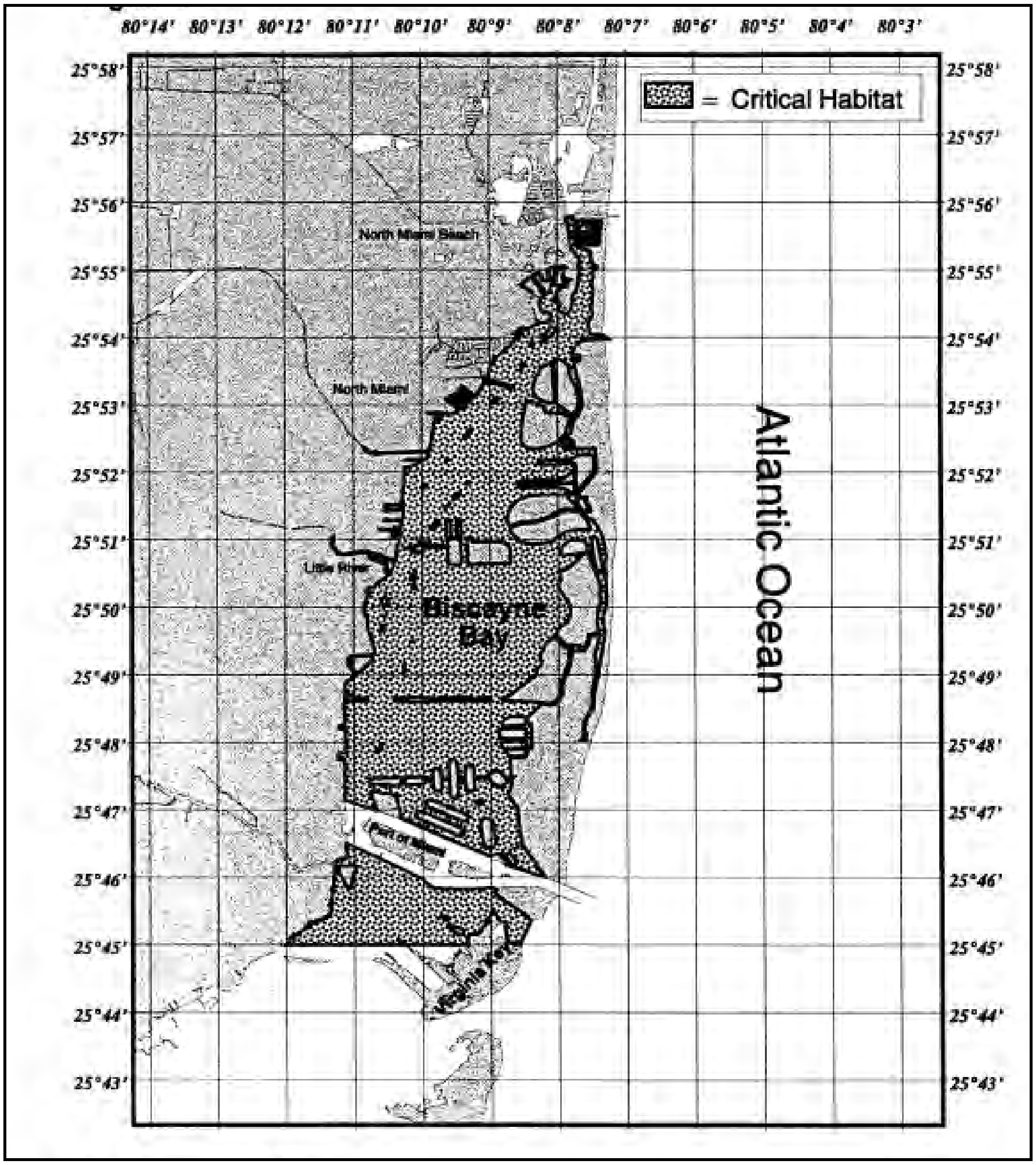


Figure 7 - Johnson's seagrass critical habitat in Biscayne Bay

Invertebrates

Staghorn and Elkhorn Corals

Staghorn (*Acropora cervicornis*) and elkhorn (*Acropora palmata*) corals were listed as threatened under the ESA on May 9, 2006, (71 FR 26852) based on a status review completed by NMFS in March 2005 (70 FR13151). NMFS published a "4D" rule for these *Acropora* species on October 29, 2008 (73 FR 64264) providing a list of activities that would result in "take" as defined by the ESA. NMFS published a final rule to designate critical habitat for these species on November 26, 2008 (73 FR 72210), however it does not include areas inside Government Cut, nor manmade structures. NOAA has not yet prepared a recovery plan for either *Acropora* species. However a recovery plan development team completed a draft and provided this to NMFS for revisions and publication. The Atlantic *Acropora* Status Review presents a summary of published literature and other currently available scientific information regarding the biology and status of both elkhorn and staghorn corals (http://www.nmfs.noaa.gov/pr/pdfs/statusreviews/corals.pdf). This information is incorporated by reference.

NMFS proposed to uplist Acroporid corals from threatened to endangered on December 7, 2012 (77 FR 73220) based on the findings of a coral status review completed as a result of a petition to list 82 coral species worldwide. The final determination on this proposal to uplist has not been made.

Proposed Coral Species

NMFS proposed to list seven Caribbean species of scleractinian corals on December 7, 2012 (77 FR 73220) in response to a petition to list 82 coral species worldwide. Species in the Caribbean proposed for listing as either endangered or threatened include: Boulder Star Coral (*Montastraea annularis and Montastraea faveolata);* Mountainous star coral (*Montastraea franksi);* Rough cactus coral (*Mycetophyllia ferox*); Pillar coral (*Dendrogyra cylindrus*); Elliptical Star Coral (*Dichocoenia stokesii*) and Lamarck's sheet coral (*Agaricia lamarcki)*.

A status review of all proposed to be listed species, including a summary of published literature and scientific information is available and incorporated by reference. (http://www.nmfs.noaa.gov/stories/2012/05/07_coral_documents_page.html)

Protective Measures to be taken in the Project Area as Part of the Proposed Action

Based on previous biological opinions issued by NMFS for adverse affects to listed *Acropora sp*., Johnson's seagrass, smalltooth sawfish and sea turtles associated with dredging and construction, the USCG plans to incorporate "terms and conditions" from these opinions into the plans and specifications for the project. These efforts will include:

1. Smalltooth Sawfish/Sea Turtles - Incorporation of the NMFS "Sea Turtle and Smalltooth Sawfish Construction Conditions" into the project plans and specifications:

a) The permittee shall instruct all personnel associated with the project of the potential presence of these species and the need to avoid collisions with sea turtles and smalltooth sawfish. All construction personnel are responsible for observing water-related activities for the presence of these species.

b) The permittee shall advise all construction personnel that there are civil and criminal penalties for harming, harassing, or killing sea turtles or smalltooth sawfish, which are protected under the Endangered Species Act of 1973.

c) Siltation barriers shall be made of material in which a sea turtle or smalltooth sawfish cannot become entangled, be properly secured, and be regularly monitored to avoid protected species entrapment. Barriers may not block sea turtle or smalltooth sawfish entry to or exit from designated critical habitat without prior agreement from the National Marine Fisheries Service's Protected Resources Division, St. Petersburg, Florida.

d) All vessels associated with the construction project shall operate at "no wake/idle" speeds at all times while in the construction area and while in water depths where the draft of the vessel provides less than a four-foot clearance from the bottom. All vessels will preferentially follow deep-water routes (e.g., marked channels) whenever possible.

e) If a sea turtle or smalltooth sawfish is seen within 100 yards of the active daily construction/dredging operation or vessel movement, all appropriate precautions shall be implemented to ensure its protection. These precautions shall include cessation of operation of any moving equipment closer than 50 feet of a sea turtle or smalltooth sawfish. Operation of any mechanical construction equipment shall cease immediately if a sea turtle or smalltooth sawfish is seen within a 50-ft radius of the equipment. Activities may not resume until the protected species has departed the project area of its own volition.

f) Any collision with and/or injury to a sea turtle or smalltooth sawfish shall be reported immediately to the National Marine Fisheries Service's Protected Resources Division (727-824-5312) and the local authorized sea turtle stranding/rescue organization.

g) Any special construction conditions, required of the project, outside these general conditions, if applicable, will be addressed in the primary consultation.

h) Relocation of scleractinian corals greater than 10cm to approved artificial reefs.

<u>State of Florida</u>

The State of Florida has numerous laws, regulations and programs aimed protecting corals and coral reef habitats, including those habitats that support Acroporid coral species. The Coral Reef Conservation Program (CRCP), as part of the Florida Department of Environmental Protection (FLDEP) coordinates research and monitoring, develops management strategies, and promotes partnerships to protect the coral reefs, hardbottom communities, and associated reef resources of southeast Florida. Through its role in supporting Florida's membership on the U.S. Coral Reef Task Force, and the U.S. All Islands Committee, the CRCP leads the implementation of the Southeast Florida Coral Reef Initiative and contributes to the National Action Plan to conserve coral reefs. The CRCP is also charged with coordinating response to vessel groundings and anchor damage incidents in southeast Florida, and developing strategies to prevent coral reef injuries. Florida Fish and Wildlife Conservation Commission's Wildlife Research Institute (FWRI) funds and conducts research activities on coral and hardbottom habitats throughout Florida, including those that support Acroporid corals and DCH.

Miami-Dade County

Miami-Dade County conducts numerous monitoring efforts throughout the county for all coral habitats, including Acroporid and the proposed corals. They also deploy artificial reefs and maintain a mooring buoy program to establish a system of mooring buoys for recreational vessels to protect natural and artificial reefs from damage caused by boat anchors (http://www.miamidade.gov/environment/adopt-a-buoy.asp). More than 40 buoys are available for use at various locations off Miami-Dade County. These sites include popular natural and artificial reef sites, including those habitats that may support Acroporid and proposed corals in Miami-Dade County. Miami-Dade County environmental staff also serves as the environmental assurance and compliance agent during county-sponsored in-water construction activities.

The Nature Conservancy

The Florida Reef Resilience Program brings scientists, reef managers and resource user groups together to develop strategies to improve the health of Florida's reefs and enhance the economic sustainability of reef-dependent commercial enterprises.

Scientific Research

NMFS provided an exception to the take prohibition for research and enhancement activities authorized by six (6) specific permit programs in the Acropora 4(d) Rule <http://sero.nmfs.noaa.gov/pr/pdf/AcroporaFinal4dRule.pdf> , they have not issued and permits under Section 10(a)(1) of the ESA to date (Jennifer Moore, pers.comm). Specifically for Miami-Dade County, any *Acropora* research would be permitted by the FWC. So long as a researcher holds a valid permit from FWC, no ESA sec 10 permit is required. NMFS may obtain a list of current permit holders from FWC as part of this consultation. As the seven proposed species have not yet been listed, there are no permits required for research at this time.

Other consultations of Federal actions in the action area to date

- None of the expansion projects authorized by Congress through 1968 were required to consult under the ESA.

- Regulatory permits issued by the Jacksonville District's Miami Field Office under Section 10 of the Rivers and Harbors Act and/or Section 404 of the Clean Water Act are required to undergo consultation under Section 7 of the ESA. NMFS-PRD should have these consultations detailed in the PCTS tracking system for analysis.

EFFECTS OF THE PROJECT ON LISTED SPECIES

The effects of the action will be broken into two sections, the maintenance dredging of the slip by either mechanical or hydraulic means and the replacement of the bulkhead with direct hammer pile driving or with vibratory pile driving.

Sea Turtles

Effects of Dredging

NMFS has previously determined (NMFS 1991, 1995, 1997 and 2003 as amended that cutterhead and mechanical and clamshell dredges are not likely to take sea turtles (NMFS, 1991):

> "Clamshell dredges are the least likely to adversely affect sea turtles because they are stationary and impact very small areas at a given time. Any sea turtle injured or killed by a clamshell dredge would have to be directly beneath the bucket. The chances of such an occurrence are extremely low, although a take of a live turtle by a clamshell dredge has been documented at Canaveral. On the basis of the best available information, NMFS has determined that dredging with a clamshell dredge is unlikely to result in the take of sea turtles."
>
> "…pipeline dredges are relatively stationary and only influence small areas at any given time. For a turtle to be taken with a pipeline dredge, it would have approach the cutterhead and be caught in the suction. This type of behavior would appear unlikely, but may be possible. Presently, NMFS has determined that pipeline dredges are unlikely to adversely affect sea turtles."

As part of the standard plans and specifications for the project, USCG agrees to implement the NMFS "Sea Turtle and Smalltooth Sawfish Construction Conditions," as detailed above in the section discussing sawfish.

Effects of Bulkhead Construction

Acoustic impacts criteria and thresholds were developed in cooperation with NMFS for sea turtle exposures to various sound sources. Only one criteria applicable to sound produced by pile driving exists for sea turtles. The NMFS threshold value for onset of injury to sea turtles due to both impact pile driving and vibratory pile driving is 190 dB re 1 µPa sound pressure level root mean square. This criteria was developed in cooperation with the NMFS and is not based on experimental evidence of injuries caused to sea turtles by pile driving sound but was adopted from pinniped thresholds as a precautionary measure when addressing impacts from pile driving to sea turtles. In the absence of reliable in-water density data for sea turtles, this criteria is useful for qualitatively assessing activities that impart sound to water.

Sound levels from pile driving are not expected to reach the 190 dB re 1 µPa sound pressure level root mean square threshold (Table 1).

Table 1. Source Levels from Pile Driving

Hammer	Pile type	RMS [dB re 1µPa at 10m]	SEL [dB re 1µPa2s at 10m]
Vibratory	24" steel pipe	163	-
	12" timber	153	-
Impact	24" steel pipe	189	179
	12" timber	170	160

Because of this, no injuries associated with sound produced by pile driving are anticipated for any species of sea turtle; however this does not preclude behavioral effects. As a precautionary measure against possible behavioral effects, a sea turtle and manatee shutdown zone of 50 ft (15 m) will be observed. If a sea turtle approaches or enters the shutdown zone, pile driving will cease and will not resume until the animal has moved out of the area.

Effects Determination

No significant effects from pile driving activities to ESA-listed green, Kemp's ridley, or leatherback turtle habitat or prey are anticipated. No significant impacts are anticipated from dredging because of these species' limited occurrence in the vicinity of the Coast Guard base. However, there is a small chance that individuals of these species may be present during in-water construction and exposed to levels of sound that could cause behavioral disturbances. As such, a may affect, not likely to adversely affect determination was made for green turtles, loggerhead turtles, hawksbill turtles, Kemp's ridley turtles, and leatherback turtles.

Smalltooth Sawfish

Effects from Dredging.

Although 11 sightings of sawfish have been made within the boundaries of Dade County within a five mile radius of the Coast Guard Station, the likelihood of sawfish being in the project area is minimal, as the Coast Guard Station does not provide optimal habitat for sawfish (Simpendorfer 2006). The proposed maintenance dredging of the slip using a cutterhead or mechanical dredge is not expected to affect the sawfish (NMFS 2003, as amended).

The assumptions and conclusions regarding cutterhead (pipeline) and mechanical (clamshell) dredges in the 1991, 1995 and 1997 South Atlantic Regional Biological Opinions (SARBO) and 2003 (as amended) Gulf Regional Biological Opinion (GRBO) (NMFS, 1991; NMFS 1995; NMFS 1997; and NMFS 2003) for sea turtles apply to sawfish as well. The 1991 SARBO states:

> "Clamshell dredges are the least likely to adversely affect sea turtles because they are stationary and impact very small areas at a given time. Any sea turtle injured or killed by a clamshell dredge would have to be directly beneath the bucket. The chances of such an occurrence are extremely low, although a take of a live turtle by a clamshell dredge has been documented at Canaveral. On the basis of the best available information, NMFS has determined that dredging with a clamshell dredge is unlikely to result in the take of sea turtles."

> "…pipeline dredges are relatively stationary and only influence small areas at any given time. For a turtle to be taken with a pipeline dredge, it would have approach the cutterhead and be caught in the suction. This type of behavior would appear unlikely, but may be possible. Presently, NMFS has determined that pipeline dredges are unlikely to adversely affect sea turtles."

The 2003 GRBO states…

> "In contrast to hopper dredges, pipeline dredges are relatively stationary, and therefore act on only small areas at any given time. In the 1980s, observer coverage was required by NOAA Fisheries at pipeline outflows during several dredging projects deploying pipeline dredges along the Atlantic coast. No turtles or turtle parts were observed in the outflow areas. Additionally, the COE's South Atlantic Division (SAD) office in Atlanta, Georgia, charged with overseeing the work of the individual COE Districts along the Eastern Seaboard from North Carolina through Florida, provided documentation of hundreds of hours of informal observation by COE inspectors during which no takes of listed species were observed. Additional monitoring by other agency personnel, conservation organizations, and the general public has never resulted in reports of turtle takes by pipeline dredges."

USCG concludes that if this statement holds true for species that are relatively abundant in South Florida like sea turtles, it should also hold true for a very rare species like sawfish.

In the 2003 GRBO, NMFS made the following determination

> "After consultation with individuals with many years in the business of providing qualified observers to the hopper dredge industry to monitor incoming dredged material for endangered species remains (C. Slay, Coastwise Consulting, pers. comm. August 18, 2003) and a review of the available scientific literature, NOAA Fisheries has determined that there has never been a reported take of a smalltooth sawfish by a hopper dredge, and such take is unlikely to occur because of smalltooth sawfishes affinity for shallow, estuarine systems."

The probability of a sawfish being taken by a cutterhead or mechanical is so unlikely as to be discountable. To help minimize the potential for sawfish take, the USCG will incorporate the NMFS sawfish protection construction protocols into the plans and specifications. All depth alternatives would result in the same impact to smalltooth sawfish as discussed for the TSP.

Based on the information included in the recovery plan, the census information from FWC and NMFS and the proposed construction techniques, USCG determined that the maintenance dredging of the Hudson's slip using a cutterhead or mechanical dredge may affect, but is not likely to adversely affect the endangered smalltooth sawfish.

NMFS also came to this determination in the recently completed Biological Opinion for the expansion of Miami Harbor (F/SER/2011/00029) with similar equipment as proposed for this project, stating:

> "NMFS has identified the following potential effects to smalltooth sawfish and has concluded that sawfish are not likely to be adversely affected by the proposed action. Effects on sawfish include the risk of injury from dredging activities, although there has never been a reported take of a smalltooth sawfish by any type of dredge. Smalltooth sawfish may be affected by being temporarily unable to use the site due to potential avoidance of construction activities and related noise, and physical exclusion from areas contained by turbidity curtains, but these effects will be insignificant. Disturbance from construction activities and related noise will be intermittent and only for part of the construction period; turbidity curtains will only enclose small areas at any one time in the project area, will be removed upon project completion, and will not appreciably interfere with use of the area by sawfish. Due to the species' mobility and the implementation of NMFS' Sea Turtle and Smalltooth Sawfish Construction Conditions, the risk of injury will be discountable."

Indirect Effects on Habitat.

Although seagrass and other soft bottom habitats will be removed, USCG does not anticipate that the proposed project will have any adverse indirect effects on smalltooth sawfish in the vicinity of the action area. These habitats may be utilized by the species, however, loss of seagrass habitats is relatively small with respect to overall seagrass abundance throughout the area as shown on Figure 8. Additionally softbottom areas are also plentiful in and near the action area, and impacts to them would not limit resource use by sawfish, especially since population density of individuals in the area is extremely low.

Figure 8 - FWC seagrass coverage map

Effects of Bulkhead Construction

Individual fish near the piling replacement work may experience sound intensities that could affect their behavior or damage their hearing ability. While many fish use their swim bladders for buoyancy, they are susceptible to rapid expansion/decompression due to peak pressure waves from underwater noises (Hastings and Popper 2005), the smalltooth sawfish lacks a swim bladder, and thus have a decreases potential to be effected by sound produced during pile driving activities.

Effects Determination

The ESA listed and smalltooth sawfish may be affected by the sound intensities, but are not likely to be adversely affected by the proposed action.

Johnson's Seagrass

A survey of sea grasses and corals around the Coast Guard base and on the bulkhead was conducted in May and June, 2013. No Johnson's seagrass was documented in the seagrass survey.

Effects from Dredging.

As no Johnson's seagrass was documented in the project footprint, there are no effects on Johnson's seagrass associated with the dredging. The project will return the slip to the original depth of -10 ft MLW (-8 feet + 2 feet of allowable overdepth) which was the depth of the berth when Johnson's seagrass critical habitat was designated by NMFS in April, 2000. This return to the original authorized depth of the slip will not adversely modify designated critical habitat, as it will return the area to original conditions when critical habitat was designated.

Effects of bulkhead construction

No effects of bulkhead construction on Johnson's seagrass are expected, as no grasses were identified in the project area.

Effects Determination

As no Johnson's seagrass was documented in the project footprint, there are no effect to the species and the proposed action will not adversely affect critical habitat for the species.

Acroporid corals

Acroporid corals were not identified in the resource survey throughout the project area.

Effects Determination

As no Acropora colonies were documented in the project footprint, there are no effects to the species. Construction of new bulkhead will potentially provide substrate for colonies, therefore, the proposed action will not adversely affect critical habitat for the species.

Proposed corals

Effects of bulkhead construction
Removal of existing bulkheads will effect proposed coral species based on findings from the 2013 survey (DCA 2013). Results from the survey show that several proposed species are present on the existing bulkheads including: Boulder Star Coral (*Montastraea faveolata);* Mountainous star coral (*Montastraea franksi);* Rough cactus coral (*Mycetophyllia ferox*); and Elliptical Star Coral (*Dichocoenia stokesii*) (Table 2).

Name	Number of colonies	Colonies >10 cm suitable for relocation	Colonies <10 cm unsuitable for relocation
Montastraea faveolata	8	8	0
Montastraea franksi	1	1	0
Mycetophyllia ferox	1	1	0
Dichocoenia stokesii	15	8	7

Table 2. Proposed corals located on the bulkheads proposed to be replaced.

Prior to initiation of any dredging activities, the USCG will require the contractor to relocate any colonies of proposed to be listed species greater than 10cm located on the bulkheads proposed to be replaced. The 10 cm size was chosen in consultation with coral relocation experts (Dr. Keith Spring, CSA pers comm.) who conveyed that corals smaller than 10cm are often flatter and more easy broken during relocation efforts. The collections will be made by coral experts and trained professionals. Even though these actions involve directed take of proposed to be listed coral colonies, they constitute a legitimate take reduction method (and NMFS has previously included this as a Reasonable and Prudent Measure) because it reduces the level of potential lethal take of corals and allows the colonies to be collected and relocated out of the impact area where they will have a high likelihood of continued survival. The Consultation Handbook (USFWS and NMFS 1998) expressly authorizes such directed take as an RPM (see page 4-53). Therefore, NMFS should evaluate the expected level of the colonies proposed for relocation as take through transplantation, so that these levels can be included in the evaluation of whether the proposed action will jeopardize the continued existence of the species.

NMFS has previously stated:
"Coral transplantation can successfully relocate colonies that would likely suffer injury or morality if not moved. Provided that colonies are handled with skill, are reattached properly, and the environmental factors at the reattachment site are conducive to their growth (e.g. water quality, substrate type, etc.), many different species of coral have

been shown to survive transplantation well (Maragos 1974, Birkeland et al. 1979, Harriott and Fisk 1988, Hudson and Diaz 1988, Guzman 1991, Kaly 1995, Berker and Mueller 1999, Tomlinson and Pratt 1999, Hudson 2000, Lindahl 2003, NCRI 2004). Transplantation of coral colonies less than 10 cm in size is not feasible because detaching such small colonies would likely result in breakage. Survivability of transplanted coral colonies less than 10 cm in size is also very low due to injury and the decrease in the overall surface area of living tissue, which reduces the colony's resilience to stress." (NMFS, 2009b).

Effects Determination

As proposed corals were identified on the existing bulkheads and these would either be relocated or lost, the USCG has determined that the project will not jeopardize the continued existence of the proposed species.

Summary Effects Determination

The Coast Guard has determined that replacing the bulkheads at Coast Guard Base Miami Beach may affect, but is not likely to adversely affect sea turtles, Johnson's seagrass, smalltooth sawfish in the project area. The Coast Guard requests concurrence on this determination. The replacement of the bulkheads will impact corals proposed to be listed but will not jeopardize the proposed to be listed coral species in the action area and the Coast Guard requests initiation of formal conference with NMFS.

SUMMARY OF EFFECT DETERMINATIONS

Project effect determination summary for sea turtle *sp.*, Johnson's seagrass, Acroporid *sp.*, proposed corals, and smalltooth sawfish (No Effect (NE – green); May Affect Not Likely to Adversely Affect (MANLAA – orange), Not Likely to Adversely Modify (NLAM – orange); Not likely to jeopardize (NLJ - yellow)

Proposed Activity	Effect Determination											
	Sea Turtle					Johnson's seagrass	Acroporid Sp.	Proposed Corals				Smalltooth Sawfish
	Leatherback	***Loggerhead***	***Green***	***Kemp's Ridley***	***Hawksbill***			***M. faveolata***	***m. franskii***	***M. ferox***	***D. stokesii***	
Hydraulic Cutterhead dredge	NE	MANLAA	MANLAA	MANLAA	MANLAA	NE	NE	NE	NE	NE	NE	MANLAA - disountable
Mechanical Dredge (Clamshell or backhoe)	NE	MANLAA	MANLAA	MANLAA	MANLAA	NE	NE	NE	NE	NE	NE	MANLAA - disountable
Bulkhead replacement – pile or vibratory hammer	NE	MANLAA	MANLAA	MANLAA	MANLAA	NE	NE	NLJ	NLJ	NLJ	NLJ	MANLAA
Critical Habitat	NA	NA	NA	NA	NA	NLAM	NA	NA	NA	NA	NA	NA

Literature Cited

Adams, W.F. and C. Wilson. The status of the smalltooth sawfish, Pristis pectinata Latham 1794 (Pristiformes: Pristidae) in the United States. Chondros, 1995.

Bak, R. P. 1978. "Lethal and Sublethal Effects of Dredging on a Coral Reef." Marine Pollution Bulleten 9(1): 14-16.

Clarke, D. G. and D. H. Wilbur. 2008. Compliance Monitoring of Dredging-Induced Turbidity: Defective Designs and Potential Solutions. Western Dredging Association St. Louis, Mo.

CSA International, Inc. 2007 During Dredging Resource Health and Sedimentation Surveys Report for May through August 2007 Hopper Dredging Activities for the Key West Harbor Dredging Project. November 2007. Prepared for Department of the Navy, Southern Division Naval Facilities Engineering Command

CSA International, Inc. 2007a Post-Dredging Resource Impact Assessment Monitoring Survey Final Report for the Key West Harbor Dredging Project (2004-2006) 7 May 2007. Prepared for Department of the Navy, Southern Division Naval Facilities Engineering Command

CSA International, Inc. 1981. Environmental Monitoring Associated with the Port Everglades Habor Deepening Project of 1980. Final Report Volumes I and II. June 16, 1981.

Davis-Colley, R.J. and D.G. Smith 2001. Turbidity, Suspended Sediment and Water Clarity: A Review. Journal of the American Water Resources Association. Vol. 37. No. 5. October 2001.

Dial Cordy and Associates. Miami Beach Coast Guard Station Seagrass and Coral Survey. August 2013. Prepared for the USACE Jacksonville District

Dodge, RE and JR Vaisnys. 1977. Coral populations and growth patterns: responses to sedimentation and turbidity associated with dredging - J. mar. Res, 1977

Hastings, M. C. & Popper, A. N. (2005). *Effects of sound on fish*. Report to California Department of Transportation. pp. 1-82

Illingworth & Rodkin, Inc. (2001). *Noise and Vibration Measurements Associated with the Pile Installation Demonstration Project for the San Francisco-Oakland Bay Bridge East Span Chapter 4*. Prepared by Illingworth and Rodkin, Petaluma, CA. Prepared for the California Department of Transportation, Sacramento, CA.

Kenworthy, J.W. 1997. An updated biological status review and summary of the proceedings of a workshop to review the biological status of the seagrass, *Halophila johnsonii* Eiseman. Report to the Office of Protected Resources. National Marine Fisheries Service, Silver Spring, MD. 23pp

NMFS, 1991. Biological Opinion – Dredge of channels in the southeastern United States from North Carolina through Cape Canaveral, Florida. Signed November 25, 1991.

NMFS, 1995. Endangered Species Act Section 7 Consultation with the U.S. Army Corps of Engineers, South Atlantic Division on Hopper Dredging of Channels and Borrow Areas in the Southeastern U.S. from North Carolina through Florida East Coast. Signed August 25, 1995.

NMFS, 1997. Endangered Species Act Section 7 Consultation with the U.S. Army Corps of Engineers, South Atlantic Division on the Continued Hopper dredging channels and borrow areas in the southeastern United States. Signed September 25, 1997.

NMFS, 1998. Endangered and Threatened Species; Threatened Status for Johnson's seagrass. 63 FR 49035. September 14, 1998.

NMFS, 2000. Designated Critical Habitat: Critical Habitat for Johnson's Seagrass Federal Register / Vol. 65, No. 66 / Wednesday, April 5, 2000

NMFS, 2002. Final Recovery Plan for Johnson's seagrass (Halophila johnsonii). Prepared by the Johnson's Seagrass Recovery Team. September 2002.

NMFS, 2003. Endangered Species Act Section 7 Consultation with the U.S. Army Corps of Engineers for Dredging of Gulf of mexico Navigation channels and San Mining "borrow" areas using hopper dredges by COE Galveston, New Orleans, Mobile and Jacksonville Districts. Consultation Number F/SER/2000/01287. Signed November 19, 2003 and revised June 24, 2005.

NMFS, 2005. Endangered and Threatened Species; Proposed Threatened Status for Elkhorn Coral and Staghorn Coral. 70 FR 24359. May 9, 2005.

NMFS, 2006. Endangered and Threatened Species; Threatened Status for Elkhorn Coral and Staghorn Coral. 71 FR 26852. May 9, 2006.

NMFS, 2007. Endangered Species Act 5-Year Review Johnson's Seagrass. Available on-line: http://www.nmfs.noaa.gov/pr/pdfs/species/johnsonsseagrass_5yearreview.pdf

NMFS, 2008a. 50 CFR Part 223. Docket No. 070801431–81370–02. Endangered and Threatened Species; Conservation of Threatened Elkhorn and Staghorn Corals. "4D rule". 73 FR 64264.

NMFS, 2008b. 50 CFR Parts 223 and 226. Docket No. 070801431–81370–02 Endangered and Threatened Species; Critical Habitat for Threatened Elkhorn and Staghorn Corals. 73 FR 72210.

NMFS, 2009a. Recovery Plan for Smalltooth Sawfish (*Pristis pectinata*). Prepared by the Smalltooth Sawfish Recovery Team for the National Marine Fisheries Service, Silver Spring, Maryland.

NMFS, 2009b. Endangered Species Act - Section 7 Consultation Biological Opinion. Dade County Beach Erosion Control Project, Contract "E," located in Dade County, Florida (Consultation Number *F/SERl2009/00879).* October 24, 2009.

NMFS 2011. Endangered Species Act - Section 7 Consultation Biological Opinion Dredging and expansion of Miami Harbor, Miami-Dade County, Florida (Consultation Number F/SER/2011/00029*).* September 8, 2011.

NMFS, 2012. Endangered Species Act - Section 7 Consultation. Concurrence with USACE determination that placement of O&M material on JUL beach May affect, but is not likely to adversely affect listed species, or adversely modify designated critical habitat. August 8, 2012.

NMFS, 2012. Status Review Report of 82 Candidate Coral Species Petitioned Under the U.S. Endangered Species Act. Pacific Islands Fisheries Science Center National Marine Fisheries Service. National Oceanic and Atmospheric Administration. U.S. Department of Commerce

Simpfendorfer, C.A. 2006. Movement and habitat use of smalltooth sawfish. Final Report. Mote Marine Laboratory Technical Report 1070. NOAA Purchase Order WC133F-04-SE-1543. January 2006.

Soong, K and J.C. Lang. 1992. Reproductive integration in coral reefs. Biol Bull 183: 418-431

U.S. Army Corps of Engineers. 2000. Final Environmental Assessment, Renourishment at Miami Beach in the Vicinity of 63rd Street, Beach Erosion Control and Hurricane Protection Project, Dade County, Florida.

USFWS and NMFS, 1998. Endangered Species Consultation Handbook. Procedures for Conducting Consultation and Conference Activities Under Section 7 of the

Endangered Species Act. U.S. Fish &Wildlife Service and National Marine Fisheries Service. March 1998.

Virnstein, R.W. and L.. Hall, 2009. Northern Range extension of the seagrass *Halophila johnsonii* and *Halophila decipens* along the east coast of Florida, USA.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Regional Office
263 13th Avenue South
St. Petersburg, Florida 33701-5505
http://sero.nmfs.noaa.gov

FEB 10 2015

F/SER31: KBD
SER-2014-13911

Colonel Alan Dodd, Commander
Jacksonville District, Corps of Engineers
Department of the Army
P.O. Box 4970
Jacksonville, Florida 32232

Andy Bobick
Chief, Environmental Branch
U.S. Coast Guard Civil Engineering Unit Miami
15608 SW 117th Avenue
Miami, Florida 33177-1630

Ref.: U.S. Coast Guard (USCG) Base Miami Beach, Maintenance Dredging and Bulkhead Replacement, Miami Beach, Miami-Dade County, Florida

Dear Colonel Dodd and Mr. Bobick:

Enclosed is the National Marine Fisheries Service's (NMFS's) Biological Opinion ("Opinion") to the U.S. Army Corps of Engineers (USACE) on the proposed authorization to maintenance dredge the slip for the USCG Cutter *Hudson* and to replace 2 bulkhead sections in Biscayne Bay. The Opinion analyzes the project's effects on loggerhead sea turtles (*Caretta caretta*), Kemp's ridley (*Lepidochelys kempii*), leatherback (*Dermochelys coriacea*), hawksbill *(Eretmochelys imbricata*), and green sea turtles (*Chelonia mydas*); smalltooth sawfish (*Pristis pectinata*); Johnson's seagrass designated critical habitat; and threatened corals including 3 newly listed species: mountainous star coral (*Orbicella faveolata*); boulder star coral (*Orbicella franksi*); and rough cactus coral (*Mycetophyllia ferox*); in accordance with Section 7 of the Endangered Species Act (ESA) of 1973. The USACE is serving as the USCG's agent for this action.

This Opinion is based on information provided in your April 16, 2014, letter and supporting information, as well as information from previous NMFS consultations conducted on dredging within seagrass habitat critical habitat and coral transplantation. You are reminded that any changes to the proposed action may negate the findings of the present consultation and may require reinitiation of consultation with NMFS. It is our Opinion that the action, as proposed, is not likely to adversely affect smalltooth sawfish, loggerhead, Kemp's ridley, leatherback, hawksbill, or green sea turtles, but it is likely to adversely affect Johnson's seagrass critical habitat and mountainous star, boulder star, and rough cactus coral.

We look forward to further cooperation with you on other projects to ensure the conservation and recovery of our threatened and endangered marine species. If you have any questions regarding this consultation, please contact Kay Davy, Consultation Biologist, by email at Kay.Davy@noaa.gov or (727) 415-9271.

Sincerely,

Roy E. Crabtree, Ph.D.
Regional Administrator

Enclosure
File: 1514-22.F.4

Endangered Species Act - Section 7 Consultation
Biological Opinion

Agencies:	United States Army Corps of Engineers (USACE) United States Coast Guard (USCG)
Activity:	USCG Base Miami Beach, Dredging and Bulkhead Replacement, Miami-Dade County, Florida
Consulting Agency:	National Marine Fisheries Service (NMFS) Southeast Regional Office Protected Resources Division
	NMFS Consultation No. SER-2014-13911
Date Issued:	2/10/15
Approved By:	Roy E. Crabtree, Ph.D. Regional Administrator

Glossary of Commonly Used Acronyms

CCA	Crustose Coralline Algae
DPS	Distinct Population Segment
DWH	Deepwater Horizon
EPA	Environmental Protection Agency
ESA	Endangered Species Act of 1973
HCD	Habitat Conservation Division
ITS	Incidental Take Statement
MMPA	Marine Mammal Protection Act of 1972
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
ODMDS	Ocean Dredged Material Disposal Site
RBO	Regional Biological Opinion
RPMs	Reasonable and Prudent Measures
SARBO	South Atlantic Regional Biological Opinion
SEFSC	Southeast Fisheries Science Center
SERO	Southeast Regional Office
STSSN	Sea Turtle Stranding and Salvage Network
USACE	United States Army Corps of Engineers
USCG	United States Coast Guard
USFWS	United States Fish and Wildlife Service

Background

Section 7(a)(2) of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. §1531 et seq.), requires that each federal agency ensure that any action authorized, funded, or carried out by the agency is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat of those species. When the action of a federal agency may affect a protected species or its critical habitat, that agency is required to consult with either National Marine Fisheries Service (NMFS) or the U.S. Fish and Wildlife Service (USFWS), depending upon the protected species that may be affected.

Consultations on most listed marine species and their designated critical habitat are conducted between the action agency and NMFS. Consultations are concluded after NMFS determines the action is not likely to adversely affect listed species or critical habitat or issues a Biological Opinion ("Opinion") that determines whether a proposed action is likely to jeopardize the continued existence of a federally-listed species, or destroy or adversely modify federally-designated critical habitat. The opinion also states the amount or extent of listed species incidental take that may occur and develops nondiscretionary measures that the action agency must take to reduce the effects of said anticipated/authorized take. The opinion may also recommend discretionary conservation measures. No incidental destruction or adverse modification of critical habitat may be authorized. The issuance of an Opinion detailing NMFS's findings concludes ESA Section 7 consultation.

This document represents our Opinion on impacts associated with proposed dredging and bulkhead replacement at USCG Base Miami Beach. This Opinion analyzes project effects on swimming sea turtles, smalltooth sawfish, threatened corals, and Johnson's seagrass critical habitat in accordance with Section 7 of the ESA. NMFS based this Opinion on project information provided by the USACE as well as published literature and the best available scientific and commercial information. It is NMFS's Opinion that the action, as proposed, is not likely to adversely affect sea turtles and smalltooth sawfish. The proposed action is also not likely to jeopardize the continued existence of mountainous star coral, boulder star coral, and rough cactus coral, and is not likely to destroy or adversely modify the designated critical habitat for Johnson's seagrass.

BIOLOGICAL OPINION

1 Consultation History

On April 16, 2014, the USACE submitted a request for Section 7 consultation and provided a biological assessment for the USCG Base Miami Beach project. The review was assigned to a Protected Resources Division Consultation Biologist on May 7, 2014. Due to a large backlog in project reviews, consultation was not initiated until July 14, 2014. On August 26, 2014, NOAA announced that 5 new species of corals were listed as threatened in the Atlantic/Caribbean (79 FR 53852; officially published September 10, 2014). Three of these threatened coral species occur within the project footprint attached to the existing bulkhead and will be relocated as a reasonable and prudent measure.

2 Description of the Proposed Action

The project is located at the USCG Base Miami Beach in Miami-Dade County, Florida, on a man-made island north of the main entrance to the Port of Miami, Government Cut (Figure 1). It is located in the Biscayne Bay Aquatic Preserve.

Figure 1. Location of USCG Base Miami

The USCG is proposing to maintenance dredge the slip used by the Coast Guard Cutter *Hudson* and replace vessel mooring bulkheads on the east and south side of the base. The slip was last dredged in 1995 and covers 0.59 acre. Dredging will be conducted using either a clamshell/backhoe or a small cutterhead dredge. Dredged material will be placed at the Miami Ocean Dredged Material Disposal Site (ODMDS). The existing bulkhead is steel sheet pile with a concrete cap that was constructed in the 1940s with additional construction occurring later in the 1960s and partial replacement occurring in the 1980s. The project includes the replacement of approximately 1,261 linear feet (lin ft) of the existing concrete cap and sheet pile bulkhead. A vibratory hammer will be used to drive the new piles into the substrate, with impact hammer driving used an alternate method if greater force is required to drive the piles to refusal depth. The new bulkhead will be positioned waterward of the existing bulkhead. Sections of the existing bulkhead have reached the end of their service life such that vehicle loading is restricted on the shore side, which impacts the operations of the USCG's vessels. No net change in the amount of vessel traffic in and around the base is expected as a result of the project. There are no mangroves in the project vicinity. Water depths range from 4-8 ft in one of the work areas where bulkhead will be replaced and 8-22 ft in the second area of the bulkhead replacement. Siltation barriers will be used that will be made of material that will prevent sea turtles or sawfish from entanglement. They will be properly secured and regularly monitored to avoid protected species entrapment. The majority of the site bottom is rock rubble with debris (i.e., automobile tires) occurring near the bulkhead.

The site is located in Johnson's seagrass critical habitat. While 0.42 acre of seagrass (i.e., paddle grass, shoal grass, and turtle grass) was documented within the dredging footprint and adjacent side-slope areas, no Johnson's seagrass was found within the project site. Seagrass mitigation consisting of planting approximately 0.5 acre of seagrass at the Julia Tuttle Mitigation Area is proposed. During the site survey, approximately 580 scleractinian corals representing 18 species were documented on the bulkheads. Approximately 1/3 of the corals are larger than 10 centimeters (cm) in diameter. Three species of listed corals were found during the survey (mountainous star, boulder star, and rough cactus). Prior to dredging and replacing the bulkhead, USCG will transplant healthy stony corals measuring greater than 10 cm in diameter to the Miami Science Museum's approved coral nursery.

All in-water construction activities shall occur during daylight hours between 1 hour after sunrise and 1 hour before sunset. As a precautionary measure against possible behavioral effects to sea turtles, a shutdown zone of 50 ft will be observed. If a sea turtle approaches or enters the shutdown area, pile driving will cease and will not resume until the turtle has moved out of the area. The USCG will comply with NMFS's *Sea Turtle and Smalltooth Sawfish Construction Conditions* dated March 23, 2006 (enclosed).

3 Action Area

The action area is defined by regulation as "all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action" (50 CFR 402.02). The action area for this project includes the USCG Base Miami Beach, which is located in Miami-Dade County, Florida. The action area also includes the Miami ODMDS spoil disposal site and the coral and seagrass mitigation sites.

4 Status of Listed Species and Critical Habitat

The following endangered (E), threatened (T), and designated critical habitat under the jurisdiction of NMFS may occur in or near the action area.

Table 1. Listed Species and Critical Habitat Likely to Occur in or Near the Project Area

Common Name	Listed Species Scientific Name	Status
Turtles		
Green sea turtle	*Chelonia mydas*[1]	E/T
Kemp's ridley sea turtle	*Lepidochelys kempii*	E
Leatherback sea turtle	*Dermochelys coriacea*	E
Loggerhead sea turtle	*Caretta caretta*[2]	T
Hawksbill sea turtle	*Eretmochelys imbricata*	E
Fish		
Smalltooth sawfish	*Pristis pectinata*[3]	E
Invertebrates and Marine Plants		
Mountainous star coral	*Orbicella faveolata*	T
Rough cactus coral	*Mycetophyllia ferox*	T
Boulder star coral	*Orbicella franksi*	T
Designated Critical Habitat		
Johnson's seagrass		

4.1 *Species Not Likely to be Adversely Affected*

NMFS has analyzed the routes of potential project effects in the marine environment on 5 species of sea turtles (loggerhead, Kemp's ridley, leatherback, hawksbill, and green), and smalltooth sawfish, from the proposed action. We have identified the following potential routes of effects to sea turtles and smalltooth sawfish: (1) injury or death from potential interactions with and operation of the dredge, (2) pile driving noise impacts, and (3) avoidance of the area during construction operations due to disturbance caused by dredging and pile installation.

<u>Smalltooth Sawfish</u>

1. Smalltooth sawfish are unlikely to be found within the project area because it lacks preferred habitat (mangroves). Confirming that, no sawfish have ever been reported in the area. In the unlikely event a sawfish is present in the project area, sawfish should not be injured or killed by the dredging or construction activities because the dredges advance relatively slowly (the cutterhead dredges and mechanical-type dredges that are feasible to use in these areas are almost stationary) and are noisy, giving mobile sawfish the opportunity to get out of the way. Due to the sawfish's mobility, ability to detect the dredging equipment, and apparent avoidance behavior, the risk of injury will be discountable. No sawfish take by any type of dredge has ever been reported to NMFS.

[1] Green turtles are listed as threatened except for the Florida and Pacific coast of Mexico breeding populations, which are listed as endangered.
[2] Northwest Atlantic Ocean (NWA) DPS
[3] The U.S. DPS

Limiting construction to daylight hours only will help construction workers regularly monitor for ESA-listed species near the project areas and avoid interactions with this species. The implementation of NMFS's *Sea Turtle and Smalltooth Sawfish Construction Conditions* will further reduce the risk of injury with the requirement that all work be stopped if a smalltooth sawfish is observed less than 50 ft from the moving equipment.

2. Sawfish may also be affected by pile installation. The project proposes to use vibratory hammer, but if piles require greater force, an impact hammer may be used. Still, neither the proposed nor the alternative pile driving scenarios would result in the production of sound above the 190 dB re 1 µPa rms SEL[4] fish (sawfish) injury criteria. Because of this, no injuries associated with sound produced by pile driving are anticipated for smalltooth sawfish. Nonetheless, this does not preclude behavioral effects. As a precautionary measure against possible behavioral effects, a shutdown zone of 50 ft will be implemented for vibratory pile driving. If a smalltooth sawfish is observed approaching or entering the shutdown zone, pile driving will cease and will not resume until the animal has moved out of the area of its own volition. With the implementation of the 50-ft shutdown zone for pile driving, little opportunity exists for behavioral effects to occur within the project area, and we believe the risk of these effects occurring is discountable.
3. Smalltooth sawfish may be adversely affected by being temporarily unable to use the site due to avoidance of construction activities, related noise, and physical exclusion from areas blocked by turbidity curtains. These effects will be insignificant, given the project's limited footprint and because in-water construction actions will occur intermittently and only during daylight hours. Additionally, turbidity controls will only enclose a small portion of the project site at any time, will be removed after construction, and will not appreciably block use of the area by smalltooth sawfish.

<u>Sea Turtles</u>

1. Sea turtles may be affected by dredging. A hydraulic suction cutterhead dredge will be used to complete the dredging of the slip or a smaller, mechanical clamshell-type ("bucket") dredge may be used. Dredged material will be dumped at the Miami ODMDS, which is located in water depths greater than 415 ft deep. NMFS believes the chance of injury or death from interactions with clamshell and/or hydraulic dredging equipment is discountable as these dredge types advance very slowly and sea turtles are highly mobile and are likely to avoid the areas during construction. NMFS also believes that the chance of sea turtles being injured by dredged material disposal is also very unlikely due to the great depth of the ODMDS. Limiting construction to daylight hours only will help construction workers regularly monitor for sea turtle species near the project areas and avoid interactions with these species. The implementation of NMFS's *Sea Turtle and Smalltooth Sawfish Construction Conditions* will further reduce the risk of injury with the requirement that all work be stopped if a sea turtle is observed less than 50 ft from the moving equipment. NMFS has received very few reports of sea turtle takes associated with these dredging

---

[4]Illinworth and Rodkin. 2007. Compendium of Pile Driving Sound Data. Report Prepared for the California Department of Transportation. September 27, 2007.

methods in the South Atlantic region: only 1 (live) sea turtle has been taken by a clamshell dredge over the past 33 years. The take occurred at Cape Canaveral, Florida, which routinely has very high local sea turtle abundance. Cold-stunned turtles have also been taken by cutterhead dredging, but this also rarely happens and has been generally limited to shallow, confined waters (e.g., Laguna Madre, Texas) or bays where turtles get trapped and stunned when the rapid passage of a cold front causes the temperature of the shallow water body to drop abruptly. Due to the infrequency of interactions with these gear types and the project location, NMFS believes that the likelihood of cold stunning occurring is discountable and also that the possibility of a sea turtle being taken by a hydraulic cutterhead or a clamshell dredge is discountable.

2. Sea turtles may also be affected by pile installation. The project proposes to use vibratory hammer, but if pilings require greater force, an impact hammer may be used. However, neither the proposed nor the alternative pile driving scenarios would result in the production of sound above the 190 dB re 1 µPa rms SEL[5] sea turtle injury criteria. Because of this, no injuries associated with sound produced by pile driving are anticipated for sea turtles; however, this does not preclude behavioral effects. As a precautionary measure against possible behavioral effects, a shutdown zone of 50 ft will be implemented for vibratory pile driving. If a sea turtle is observed approaching or entering the shutdown zone, pile driving will cease and will not resume until the animal has moved out of the area of its own volition. With the implementation of the 50-ft shutdown zone for pile driving, little opportunity exists for behavioral effects to occur within the project area, and we believe the risk of these effects occurring is discountable.
3. Sea turtles may be adversely affected by being temporarily unable to use the site due to avoidance of construction activities, related noise, and physical exclusion from areas blocked by turbidity curtains. These effects will be insignificant, given the project's limited footprint and because in-water construction actions will occur intermittently and only during daylight hours. Additionally, turbidity controls will only enclose a small portion of the project site at any time, will be removed after construction, and will not appreciably block use of the area by sea turtles.

4.2 Species and Critical Habitat Likely to be Adversely Affected

NMFS believes that the proposed project may adversely affect 3 listed coral species and Johnson's seagrass critical habitat.

4.2.1 Corals: Mountainous Star, Boulder Star and Rough Cactus

In December 2012, NMFS proposed to list 7 coral species (lobed star, mountainous star, boulder star, pillar, rough cactus, Lamarck's sheet, and elliptical star coral) in the western Atlantic, Gulf of Mexico, and/or Caribbean basins under the ESA (77 FR 73219; December 7, 2012). On September 10, 2014, NMFS determined that 5 species should be listed as threatened, including 3

[5] Illinworth and Rodkin. 2007. Compendium of Pile Driving Sound Data. Report Prepared for the California Department of Transportation. September 27, 2007

that will be adversely affected by the proposed action: mountainous star, boulder star, and rough cactus corals (79 FR 53851).

General information about corals that pertains to all the listed coral species is presented at the beginning of each of the subsections. Species-specific information is then presented for each of the listed coral species. However, mountainous star and boulder star corals are presented together since information is often only available for the species complex rather than the individual species.

4.2.1.1 Species Description

Corals are marine invertebrates in the phylum Cnidaria, which include true stony corals, the blue corals, and fire corals. All of the currently-listed and proposed corals in the NMFS Southeast Region (North Carolina through Texas and the U.S. Caribbean) are stony corals. Stony corals are characterized by polyps with multiples of 6 tentacles around the mouth for feeding and capturing prey items in the water column (Brainard et al. 2011b). Most stony corals form complex colonies made up of a tissue layer of polyps growing on top of a calcium carbonate skeleton, which the polyps produce through the process of calcification.

All of the listed and coral species are reef building species, which are capable of rapid calcification rates because of their symbiotic relationship with single-celled dinoflagellate algae, zooxanthellae, which occur in great numbers within the host coral tissues. Zooxanthellae photosynthesize during the daytime, producing an abundant source of energy for the host coral that enables rapid growth. At night, polyps extend their tentacles to filter-feed on microscopic particles in the water column, such as zooplankton, providing additional nutrients for the host coral. In this way, reef-building corals obtain nutrients autotrophically (i.e., via photosynthesis) during the day, and heterotrophically (i.e., via predation) at night (Brainard et al. 2011a).

4.2.1.1.1 Mountainous Star and Boulder Star Corals

Mountainous star coral (*Orbicella faveolata*) and boulder star coral (*Orbicella franksi*) are species in the *Orbicella annularis* complex. These species were formerly in the genus *Montastraea*; however, recent work has reclassified 3 species in the *annularis* complex to the genus *Orbicella* (Budd et al. 2012). The species complex was historically one of the primary reef framework builders throughout the wider Caribbean. The complex was considered a highly plastic, single species – *Montastraea annularis* – with growth forms ranging from columns, to massive boulders, to plates. In the early 1990s, Weil and Knowlton (1994) suggested the partitioning of these growth forms into separate species, resurrecting the previously described taxa, *Montastraea* (now *Orbicella*) *faveolata* and *Montastraea* (now *Orbicella*) *franksi.* These sibling species were differentiated on the basis of morphology, depth range, ecology, and behavior (Weil and Knowton 1994). Subsequent reproductive and genetic studies have generally supported the partitioning of the *annularis* complex into 3 species.

Some studies report on the species complex rather than individual species since visual distinction can be difficult where colony morphology cannot be discerned (e.g. small colonies or photographic methods). Information from these studies is reported for the species complex. Where species-specific information is available, it is reported. However, information about *O.*

annularis published prior to 1994 will be attributed to the species complex since it is dated prior to the split of *O. annularis* into 3 separate species.

Mountainous star corals grow in heads or sheets, the surface of which may be smooth or have keels or bumps. Colonies can reach up to 33 ft (10 m) in diameter with a height of 13-16 ft (4-5 m) and are commonly grey, green, and brownish in color (Szmant et al. 1997).

Boulder star corals are distinguished by large, unevenly arranged polyps that give the colony its characteristic irregular surface. Colony form is variable. Colonies can reach up to 16 ft (5 m) in diameter with a height of up to 6.5 ft (2 m) and are green, grey, and brown in color (Szmant et al. 1997).

4.2.1.1.2 Rough Cactus Coral

Rough cactus coral (*Mycetophyllia ferox*) colonies are encrusting, flat plates. Colonies are thin, weakly attached plates with interconnecting, slightly sinuous, narrow valleys. Colonies are most commonly greys and browns in color with valleys and walls of contrasting colors, and their maximum size is 20 inches (50 cm) in diameter (Veron 2000).

4.2.1.2 Distribution

In general, the corals in the Southeast Region are widely distributed throughout the western Atlantic, Caribbean, and Gulf of Mexico. Corals need hard substrate on which to settle and form; however, only a narrow range of suitable environmental conditions allows coral to grow and exceed loss from physical, chemical, and biological erosion. Reef-building corals do not thrive outside a narrow temperature range of 25°C-30°C, but they are able to tolerate temperatures outside this range for brief periods of time, depending on how long and severe the exposure to extremes, as well as other biological and environmental factors. Two other important factors influencing suitability of habitat are light and water quality. Reef-building corals require light for photosynthesis of their symbiotic algae, and poor water quality can negatively affect both coral growth and recruitment. Availability of light generally limits how deep corals are found. Hydrodynamic condition (e.g., high wave action) is another important habitat feature, as it influences the growth, mortality, and reproductive rate of each species adapted to a specific hydrodynamic zone.

4.2.1.2.1 Mountainous Star and Boulder Star Corals

These 2 species in the *Orbicella annularis* complex are distributed throughout the Caribbean, Bahamas, and Flower Garden Banks (IUCN 2010; Veron 2000). The complex occurs commonly throughout U.S. waters of the western Atlantic and Caribbean, including Florida (Martin though Monroe counties) and the Gulf of Mexico. The species occupy most reef environments, occurring in both protected and wave exposed habitats (Goreau and Wells 1967; Van Duyl 1985). Lobed star coral occurs shallower than its siblings, in depths ranging from 1.5-66 ft (0.5-20 m) (Szmant et al. 1997). Mountainous and boulder star corals can be found in depths up to 230 ft (70 m (Brainard et al. 2011b).

4.2.1.2.2 Rough Cactus Coral

Rough cactus coral occurs throughout the U.S. waters of the western Atlantic, Caribbean, and Gulf of Mexico (Veron 2000), but has not been reported from Flower Garden Banks (Hickerson et al. 2008). It has also been observed in the Bahamas, but it is absent in the waters of Bermuda. The species occurs in shallow reef environments in depths ranging from 16-98 ft (5 to 30 m (Brainard et al. 2011b).

4.2.1.3 Life History Information

Corals use a number of diverse reproductive modes (Figure 8). Many coral species reproduce sexually and asexually. Corals reproduce sexually by developing eggs and sperm within the polyps. Some coral species have separate sexes (gonochoric), while others are both sexes at the same time (hermaphroditic). Strategies for fertilization are by "brooding" or "broadcast spawning" (i.e., internal or external fertilization, respectively). Asexual reproduction occurs through fragmentation when pieces of a colony break off and re-attach to hard substrate to form a new colony. Fragmentation results in multiple genetically-identical colonies. In many species of branching corals, fragmentation is a common and sometimes dominant means of propagation.

Depending on the mode of fertilization, coral larvae (called planulae) undergo development either mostly within the mother colony (brooders) or outside in the ocean (broadcast spawners). In either mode of larval development, planula larvae presumably experience considerable mortality (up to 90% or more) from predation or other factors prior to settlement and metamorphosis. Such mortality cannot be directly observed, but is inferred from the large amount of eggs and sperm spawned versus the much smaller number of recruits observed later. Coral larvae are relatively poor swimmers; therefore, their dispersal distances largely depend on how long they remain in the water column and the speed and direction of water currents transporting the larvae. The documented maximum larval life span is 244 days (*Montastraea magnistellata* (Graham et al. 2008), which suggests that the potential for long-term dispersal of coral larvae, at least for some species, may be substantially greater than previously thought and may partially explain the large geographic ranges of many species.

Biological and physical factors that have been shown to affect spatial and temporal patterns of coral recruitment include:

- substratum availability and community structure (Birkeland 1977)
- grazing pressure (Rogers et al. 1984; Sammarco 1985)
- fecundity, mode, and timing of reproduction (Harriott 1985; Richmond and Hunter 1990)
- behavior of larvae (Goreau et al. 1981; Lewis 1974)
- hurricane disturbance (Hughes and Jackson 1985)
- physical oceanography (Baggett and Bright 1985; Fisk and Harriott 1990)
- the structure of established coral assemblages (Harriott 1985; Lewis 1974)
- chemical cues (Morse et al. 1988)

In general, upon proper stimulation coral larvae settle on appropriate substrates. Some evidence indicates that chemical cues from crustose coralline algae (CCA), microbial films, and/or other reef organisms (Gleason et al. 2009; Morse et al. 1996; Morse et al. 1994; Negri et al. 2001) or acoustic cues from fish and crustaceans in reef environments (Vermeij et al. 2010) stimulate settlement behaviors. Once a settlement site is chosen, the larvae attach to the surface and lay down a calcium carbonate skeleton. Successful recruitment of larvae is the only way new genetic individuals enter a population, thereby maintaining or increasing genotypic diversity (i.e., number of individuals if a population of clonal organisms). The larval stage is also important, as it is the only phase in the life cycle of corals where dispersal occurs over long distances. This helps genetically link populations and provides the potential to re-populate depleted areas. Because newly settled corals barely protrude above the substrate, juveniles need to reach a certain size to limit damage or mortality from threats such as grazing, sediment burial, and algal overgrowth (Bak and Elgershuizen 1976; Birkeland 1977; Sammarco 1985). Once recruits reach about 1-2 years post-settlement, growth and mortality rates appear similar across species. In some species, it appears that there is virtually no limit to colony size beyond structural integrity of the colony skeleton, as polyps apparently can bud indefinitely.

Stony corals require hard substrate for settlement of their larvae, and presence of other benthic organisms (e.g., macroalgae) can preclude settlement. Encrusting sponges and soft corals, zoanthids, and macroalgae are major coral competitors because of their ability to blanket large areas of the sea floor. The presence of macroalgae inhibits coral settlement both by competing for space and by trapping sediment that can abrade and smother small recruits. Juvenile corals are the most susceptible to overgrowth and mortality from these competitors, and corals are generally better able to compete as they grow larger (Bak and Elgershuizen 1976; Birkeland 1977).

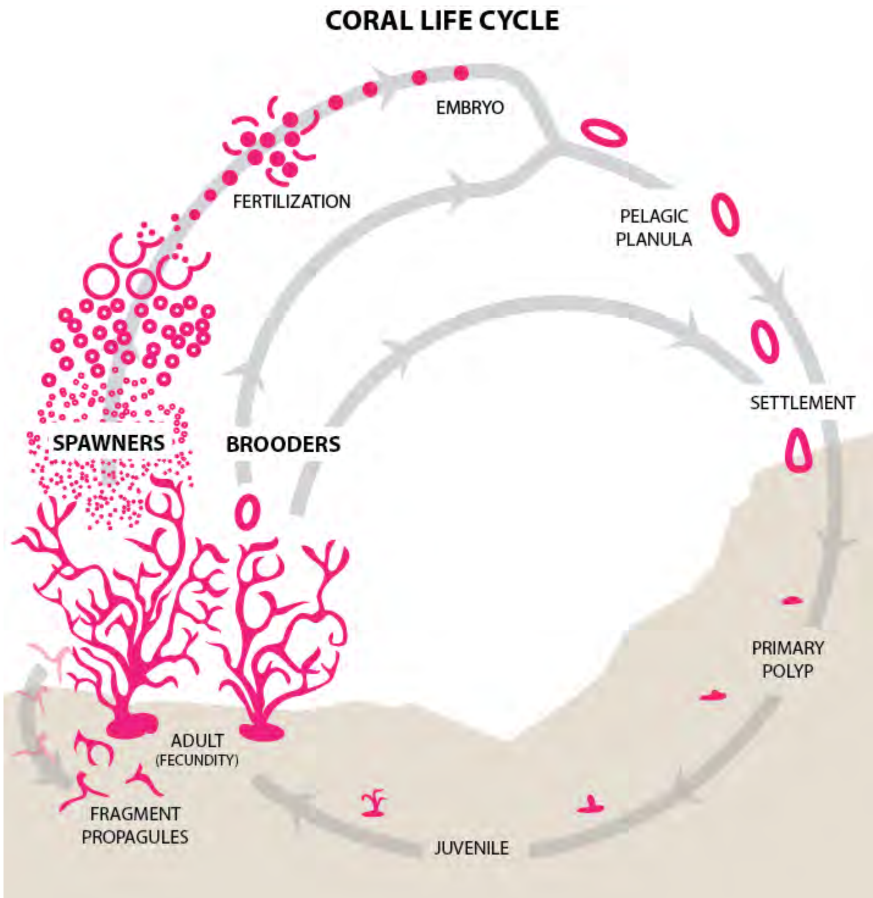


Figure 2. Coral life cycle showing different life history stages for broadcast spawners versus brooders, as well as asexual fragmentation (Reproduced from Brainard et al. 2011. Diagram prepared by Amanda Toperoff, NOAA PIFSC)

4.2.1.3.1 Mountainous Star and Boulder Star Corals

All species of the *Orbicella annularis* complex are hermaphroditic broadcast spawners, with spawning concentrated on nights 6-8 following the full moon in late summer (Levitan et al. 2004). Fertilization success measured in the field was generally below 15 % for all 3 species but was highly linked to the number of colonies observed spawning at the same time (Levitan et al. 2004). Minimum size for reproduction of the *O. annularis* species complex was found to be 13 in^2 (83 cm^2) in Puerto Rico and was estimated to correspond to 4-5 years of age (Szmant-Froelich 1985). The *Orbicella annularis* species complex typically exhibits a linear growth of ~0.4 inches (1 cm) per year (Gladfelter et al. 1978), but increased appreciation for the slow rate of growth of post-settlement stages suggest this age for minimum reproductive size may be an underestimate (M.W. Miller, Southeast Fisheries Science Center, Miami, FL. pers. obs., October 2010). Growth rates of the *O. annularis* species complex are also negatively correlated with depth and water clarity (Hubbard and Scaturo 1985). The slow post-settlement growth rates of *O. faveolata* (Szmant and Miller 2005) and small eggs (Szmant et al. 1997) and larvae of all 3 species are factors that may contribute to extremely low post-settlement survivorship, even lower than other Caribbean broadcasters, such as elkhorn coral (Szmant and Miller 2005). Spatial distribution may also affect fecundity on the reef, with deeper colonies of *O. faveolata* being less fecund due to polyp spacing (Villinski 2003).

Successful recruitment by *Orbicella annularis* complex species has seemingly always been rare. (Hughes and Tanner 2000) reported the occurrence of only a single recruit of *Orbicella* over 18 years of intensive observation of 129 ft^2 (12 m^2) of reef in Discovery Bay, Jamaica, while many other recruitment studies throughout the Caribbean also report the species complex to be negligible to absent (Bak and Engel 1979; Rogers et al. 1984). *Orbicella* spp. juveniles also have higher mortality rates than larger colonies (Smith and Aronson 2006). Despite their generally boulder-like form, at least the lobed star coral is capable of some degree of fragmentation/fission and clonal reproduction (Foster et al. 2007).

4.2.1.3.2 Rough Cactus Coral

Rough cactus coral is a hermaphroditic brooder and polyps produce 96 eggs per cycle on average (Szmant 1986). It does not reproduce via fragmentation. Their larvae contain zooxanthellae (i.e., symbiotic algae) that can supplement maternal provisioning with energy sources provided by their photosynthesis (Baird et al. 2009). Colony size at first reproduction is greater than 15.5 in^2 (100 cm^2 (Szmant 1986). Recruitment of this species appears to be very low; even studies from the 1970s reported zero settlement (Dustan 1977).

4.2.1.4 Population Dynamics and Status

Documenting population dynamics for corals is confounded by several unique life history characteristics. Particularly, clonality and asexual reproduction makes it particularly difficult to census a species to determine population abundance estimates. This can only truly be done by tracking genotypically individual colonies within a set area over time to determine if a new colonies in the population are new sexual recruits or colonies formed by asexual reproduction or partial mortality (Williams et al. 2006). This is why coral abundance estimates are usually reported in percent cover rather than number of individuals.

Asexual reproduction can play a major role in maintaining local populations, but in the absence of sexual recruitment, it can also lead to decreased resilience to stressors due to decreased genetic diversity. Since corals cannot move and are dependent upon external fertilization to produce larvae, fertilization success declines greatly as adult density declines. In populations where fragmentation happens often, the number of genetically distinct adults is even lower than colony density. Likewise, when there are fewer adult colonies, there are also fewer sources of fragments to provide for asexual recruitment. These conditions imply that once a population declines to or below a certain level (i.e., the number of adults in an area is too low for sexual reproduction to be effective), the chances for recovery are low. Thus, local (reef-scale) reductions in colony numbers and size may prevent recovery for decades.

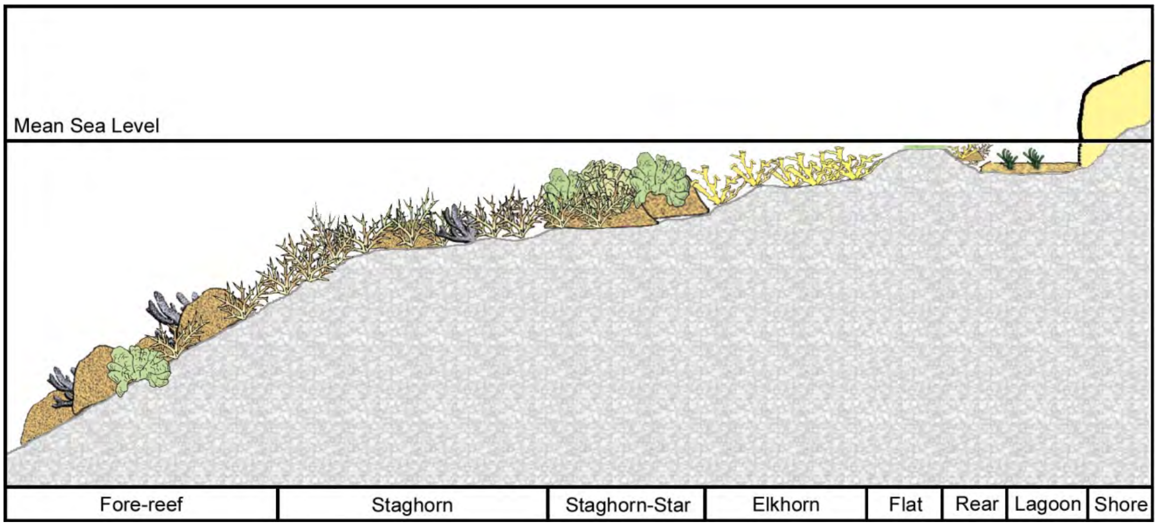


Figure 3. Generalized reef zone schematic (Acropora Biological Review Team 2005)

4.2.1.4.1 Mountainous Star and Boulder Star Corals

As described above, these species in the *Orbicella annularis* complex were not suggested for formal separation until the mid-1990s and further supported by genetic studies through 2012 (Budd et al. 2012; Fukami et al. 2004; Lopez et al. 1999; Weil and Knowton 1994). In addition, the species are potentially difficult to tell apart depending on their growth form (e.g., mounding versus platy) and survey method (e.g., video versus in situ). Therefore, many monitoring programs continue to lump the 3 species into the *O. annularis* complex. Future, focused studies may allow for more time to do field identification resulting in high confidence that the reported species is actually the one identified.

The *Orbicella annularis* species complex has historically been dominant on Caribbean coral reefs, characterizing the so-called "buttress zone" and "annularis zone" in the classical descriptions of Caribbean reefs (Goreau 1959). There is ample evidence that it has declined dramatically throughout its range, but perhaps at a slower pace than staghorn corals. While the latter began its rapid decline in the early- to mid-1980s, declines in *Orbicella annularis* complex have been much more obvious in the 1990s and 2000s, most often associated with combined disease and bleaching events. In most cases where examined, additional demographic changes accompany these instances of declining abundance (e.g., size structure of colonies, partial mortality).

In Florida, the percent cover data from 4 fixed sites have shown the *Orbicella annularis* complex declined in absolute cover from 5% to 2% in the Lower Keys between 1998 and 2003, and was accompanied by 5% to 40% colony shrinkage and virtually no recruitment (Smith et al. 2008). Earlier studies from the Florida Keys indicated a 31% decline of *Orbicella annularis* complex absolute cover between 1975 and 1982 at Carysfort Reef (Dustan and Halas 1987) and greater than 75% decline (from over 6% cover to less than 1%) across several sites in Biscayne National Park between the late 1970s and 2000 (Dupont et al. 2008). Further, Ruzicka et al. (2013) documented a Florida Keys-wide decline in all stony coral cover attributable to a decline in the *O. annularis* complex from 1999 to 2009. Most notably, they documented a 25% decline at the deep fore reef sites, where declines are typically not as dramatic. Taken together, these data imply extreme declines in the Florida Keys (80%–95%) between the late 1970s and 2003, and it is clear that further dramatic losses occurred in this region during the cold weather event in January 2010 (Colella et al. 2012).

Similar declines have also been documented for relatively remote Caribbean reefs. At Navassa Island National Wildlife Refuge, percent cover of *Orbicella annularis* complex on randomly sampled patch reefs declined from 26% in 2002 to 3% in 2009, following disease and bleaching events in this uninhabited oceanic island (Miller and Williams 2007). Additionally, 2 offshore islands west of Puerto Rico (Mona and Desecheo) showed reductions in in *O. annularis* complex species (*O. faveolata* and *O. annularis)* live colony counts of 24% and 32% between 1998-2000 and 2008, respectively (Bruckner and Hill 2009). At Desecheo, this demographic decline of one-third of the population corresponded to a decline in *Orbicella annularis* complex cover from over 35% to below 5% across 4 sites.

In the U.S. Virgin Islands, recent data from the U.S. National Park Service's Inventory and Monitoring Program across 6 sites at fixed stations show a decline of *Orbicella annularis* complex from just over 10% cover in 2003 to just over 3% cover in 2009 following mass bleaching and disease impacts in 2005 (Miller et al. 2009). This degree of recent decline was preceded by a decline from over 30% *Orbicella* coverage to approximately 10% between 1988 and 2003, as documented by Edmunds and Elahi (2007). Similarly, percent cover of *Orbicella annularis* complex in a marine protected area in Puerto Rico declined from 49% to 8% between 1997 and 2009 (Hernández-Pacheco et al. 2011). Taken together, these data suggest an 80%-90% decline in *Orbicella annularis* over the past 2 decades in the main U.S. Caribbean territories.

While Bak and Luckhurst (1980) indicated stability in *Orbicella annularis* complex cover across depths in Curaçao during a 5-year study in the mid-1970s, this region has also manifested *Orbicella annularis* complex declines in recent years. Bruckner and Bruckner (2006) documented an 85% increase in the partial mortality of *Orbicella faveolata* and *O. annularis* colonies across 3 reefs in western Curaçao between 1998 and 2005, approximately twice the level for all other stony corals combined. These authors noted that *Orbicella franksi* fared substantially better than the other 2 complex species in this study. It is likely that *Orbicella annularis* complex populations in Curaçao have fared better than other Caribbean regions, but even those populations are not immune to losses.

Orbicella annularis complex declines in additional locations are noted. For example, at Glovers Reef, Belize, McClanahan and Muthiga (1998) documented a 38%-75% decline in relative cover of *Orbicella annularis* complex across different reef zones between 1975 and 1998, and a further 40% decline in relative cover has occurred since then (Huntington et al. 2011). In contrast, , *O. franksi*, *O. faveolata*, and *O. annularis* populations have shown stable status at sites in Colombia between 1998 and 2003 (Rodriguez-Ramirez et al. 2010), although demographic changes in *Orbicella annularis* at both degraded and less-degraded reefs imply some degree of population decline in this region (Alvarado-Chacon and Acosta 2009).

In the recently finalized rule listing *Orbicella faveolata* and *O. franksi* as threatened species, NMFS summarized the best available information on population abundance estimates for these species. Extrapolated population estimates from stratified random samples in the Florida Keys were 39.7 ± 8 million (SE) colonies in 2005, 21.9 ± 7 million (SE) colonies in 2009, and 47.3 ± 14.5 million (SE) colonies in 2012. The greatest proportion of colonies tended to fall in the 10 to 20 cm and 20 to 30 cm size classes in all survey years, but there was a fairly large proportion of colonies in the greater than 90 cm size class. Partial mortality of the colonies was between 10 and 60 percent surface across all size classes. In the Dry Tortugas, Florida, O. faveolata ranked seventh most abundant out of 43 coral species in 2006 and fifth most abundant out of 40 in 2008. Extrapolated population estimates were 36.1 ± 4.8 million (SE) colonies in 2006 and 30 ± 3.3 million (SE) colonies in 2008. The size classes with the largest proportion of colonies were 10 to 20 cm and 20 to 30 cm, but there was a fairly large proportion of colonies in the greater than 90 cm size class. Partial mortality of the colonies ranged between approximately two percent and 50 percent. Because these population abundance estimates are based on random surveys, differences between years may be attributed to sampling effort rather than population trends (Miller et al., 2013).

For *O. franksi*, Extrapolated population estimates from stratified random surveys were 8.0 ± 3.5 million (SE) colonies in 2005, 0.3 ± 0.2 million (SE) colonies in 2009, and 0.4 ± 0.4 million (SE) colonies in 2012. The authors note that differences in extrapolated abundance between years were more likely a function of sampling effort rather than an indication of population trends. In 2005, the greatest proportions of colonies were in the smaller size classes of 10 to 20 cm and 20 to 30 cm. Partial colony mortality ranged from zero to approximately 73 percent and was generally higher in larger colonies (Miller et al., 2013). In the Dry Tortugas, Florida, O. franksi ranked fourth highest in abundance out of 43 coral species in 2006 and eighth out of 40 in 2008. Extrapolated population estimates were 79 ± 19 million (SE) colonies in 2006 and 18.2 ± 4.1 million (SE) colonies in 2008. The authors note the difference in estimates between years was more likely a function of sampling effort rather than population decline. In the first year of the study (i.e., 2006), the greatest proportion of colonies were in the size class 20 to 30 cm with twice as many colonies as the next most numerous size class , and a fair number of colonies in the largest size class of greater than 90 cm. Partial colony mortality ranged from approximately ten to 55 percent. Two years later in 2008 no size class was found to dominate, and proportion of colonies in the medium to large size classes (60 to 90 cm) appeared to be less than in 2006. The number of colonies in the largest size class of greater than 90 cm remained consistent. Partial colony mortality ranged from approximately 15 to 75 percent (Miller et al., 2013).

4.2.1.4.2 Rough Cactus Coral

Rough cactus coral is usually uncommon (Veron 2000) or rare according to published and unpublished records. It constitutes less than 0.1% species contribution (percent of all colonies surveyed) and occurs at densities less than 0.08 colonies per 1 m^2 in Florida (Wagner et al. 2010) and at 0.8 colonies per 100 m transect in Puerto Rico sites sampled by the Atlantic and Gulf Rapid Reef Assessment (Ginsburg and Lang 2003). Recent monitoring data (e.g., since 2000) from Florida (National Park Service permanent monitoring stations), La Parguera, Puerto Rico, and St. Croix (USVI/NOAA Center for Coastal Monitoring and Assessment randomized monitoring stations) show *Mycetophyllia ferox* cover to be consistently less than 1%, with occasional observations up to 2%, and no apparent temporal trend.

Dustan 1977) suggests that *Mycetophyllia ferox* was much more abundant in the upper Florida Keys in the early 1970s than current observations, but that it was highly affected by disease. This data could be interpreted as a substantial decline. Long-term Coral Reef Evaluation and Monitoring Project (CREMP) data in Florida on species presence/absence from fixed stations also show a dramatic decline. For 97 stations in the main Florida Keys, occurrence had declined from 20 stations in 1996 to 4 stations in 2009; in Dry Tortugas occurrence had declined from 8 out of 21 stations in 2004 to 3 stations in 2009 (R. Ruzicka and M. Colella, Florida Marine Research Institute, St. Petersburg, Florida pers. comm. to Jennifer Moore, NMFS, Oct 2010). Recruitment of this species appears to be very low; even studies from the 1970s reported zero settlement (Dustan 1977).

In the recently finalized rule listing *Mycetophyllia ferox* as a threatened species, NMFS summarized the best available information on population abundance estimates for this species. In stratified random surveys in the Florida Keys, *M. ferox* ranked 39th most abundant out of 47 in 2005, 43rd out of 43 in 2009, and 40th out of 40 in 2012. Extrapolated population estimates were 1.0 ± 0.7 (SE) million in 2005, 9,500 ± 9,500 (SE) colonies in 2009, and 7,000 ± 7,000 (SE) in 2012 . These abundance estimates are based on random surveys, and differences between years are more likely a result of sampling effort rather than population trends. The most abundant size class was 10 to 20 cm diameter that equaled the combined abundance of the other size classes. The largest size class was 30 to 40 cm. Average partial mortality per size class ranged from nearly 0 to 50 percent and was greatest in the 20 to 30 cm size class (Miller et al., 2013). In the Dry Tortugas, Florida, *M. ferox* ranked 35th most abundant out of 43 species in 2006 and 30th out of 40 in 2008. Population estimates were 0.5 ± 0.4 (SE) million in 2006 and 0.5 ± 0.2 million (SE) in 2008. The number of colonies in 2006 was similar between the 0 to 10 cm and 10 to 20 cm size classes, and the largest colonies were in the 20 to 30 cm size class. Greatest partial mortality was around 10 percent. Two years later, in 2008, the highest proportion of colonies was in the 20 to 30 cm size class, and the largest colonies were in the 40 to 50 cm size class. The greatest partial mortality was about 60 percent in the 30 to 40 cm size class, however the number of colonies at that size were few (Miller et al., 2013).

4.2.1.5 Threats

4.2.1.5.1 Ocean Warming

Mean seawater temperatures in reef-building coral habitats have increased during the past few decades and are predicted to continue to rise between now and 2100 (IPCC 2013). More importantly, the frequency of warm-season temperature extremes (warming events) in reef-building coral habitat has increased during the past 2 decades and is also predicted to increase between now and 2100 (IPCC 2013). The primary observable coral response to ocean warming is bleaching of coral colonies, wherein corals expel their symbiotic algae (zooxanthellae) in response to stress. Bleaching can affect coral growth, maintenance, reproduction, and survival. An episodic increase of only 1°C-2°C above the normal local seasonal maximum ocean temperature can induce bleaching. Although corals can withstand mild to moderate bleaching, severe, repeated, or prolonged bleaching can lead to colony death and has led to the mass mortality of many coral species during the past 30 years.

In addition to coral bleaching, ocean warming detrimentally affects virtually every life-history stage in reef-building corals. For one Indo-Pacific *Acropora* species, abnormal embryonic development occurs at 32°C, and complete fertilization failure occurs at 34°C (Negri et al. 2007). Further, symbiosis establishment, larval survivorship, and settlement success are impaired in some coral species at temperatures as low as 30°C-32°C (Randall and Szmant 2009; Ross et al. 2013; Schnitzler et al. 2012). Warmer temperatures accelerate the rate of larval development for spawning species, which reduces dispersal distances, the likelihood of successful settlement, and the potential for replenishment of depleted areas (Randall and Szmant 2009).

Multiple threats stress corals simultaneously or sequentially, whether the effects are cumulative, synergistic, or antagonistic. Ocean warming is likely to interact with many other threats, especially considering the long-term consequences of repeated thermal stress, since ocean warming is expected to worsen over this century. Increased seawater temperature interacts with coral diseases to reduce coral health and survivorship. Coral disease outbreaks often have accompanied or immediately followed bleaching events and follow seasonal patterns of high seawater temperatures. The effects of greater ocean warming (i.e., increased bleaching, which kills or weakens colonies) are expected to interact with the effects of higher storm intensity (i.e., increased breakage of dead or weakened colonies) in the Caribbean, resulting in increased rates of coral declines. Likewise, land-based runoff, pollution, or other local stressors may worsen bleaching impacts by increasing coral susceptibility to bleaching and/or increasing the duration of lowered growth after a bleaching event (Carilli et al. 2009; Wooldridge 2009).

4.2.1.5.2 Ocean Acidification

Ocean acidification is a result of increased greenhouse gas accumulation, primarily carbon dioxide, in the atmosphere. Ocean acidification is a drop in the pH of seawater that occurs in response to increases in atmospheric carbon dioxide levels that change ocean carbonate chemistry (Caldeira and Wickett 2003). The aragonite saturation state measures the concentration of carbonate ions in the ocean. Corals use carbonate ions to build calcium carbonate skeletons. Thus, decreasing pH and aragonite saturation state are expected to have a major impact on corals and other marine organisms this century by making it more difficult for them to build their skeletons (Fabry 2008). Numerous laboratory and field experiments have shown a relationship between elevated carbon dioxide and decreased calcification rates in particular corals and other calcium carbonate secreting organisms such as CCA (Bates et al. 2009; De Putron et al. 2010; Doney et al. 2009; Langdon et al. 2003). Low-saturation-state water also decreases the rate of biochemical processes that create the cements that infill reefs. A major potential impact from ocean acidification is a reduction in the structural stability of corals and reefs, which results both from increases in bioerosion and decreases in reef cementation. As atmospheric carbon dioxide rises globally, reef-building corals are expected to calcify more slowly and become more fragile.

Laboratory experiments have shown that a declining aragonite saturation state slows the start of and the rate at which newly settled coral larvae create carbonate skeletons (Albright et al. 2008; Cohen et al. 2007; Cohen et al. 2009). Slower growth implies even higher rates of mortality for newly settled corals that are vulnerable to overgrowth competition, sediment smothering, and incidental predation until they reach a refuge at larger colony size. In addition to effects on growth and calcification, recent laboratory experiments have shown that increased carbon dioxide also substantially impairs coral fertilization and settlement success (Albright et al. 2010), suggesting a potential further reduction in recruitment. Community medium-scale studies (Jokiel et al. 2008; Kuffner et al. 2008) showed dramatic declines in the growth rate of CCA and other reef organisms and an increase in the growth of fleshy algae at atmospheric carbon dioxide levels expected later this century. The decrease in CCA growth, coupled with rapid growth of fleshy algae will result in less available habitat for settlement and recruitment of new coral colonies.

Acidification is likely to interact with other threats. Ocean acidification may reduce the temperature threshold at which bleaching occurs (Anthony et al. 2011). Reduced skeletal growth compromises the ability of coral colonies to compete for space against algae, which grows more quickly as nutrient over-enrichment increases. Reduced skeletal density weakens coral skeletons, resulting in greater colony breakage from natural and human-induced physical damage.

4.2.1.5.3 Disease

Coral diseases are common and significant threats affecting most coral species. Disease can cause mortality, reduced sexual and asexual reproductive success, and impaired colony growth. A diseased state results from a complex interplay of factors including the cause or agent (e.g., pathogen, environmental toxicant), the host, and the environment. In the case of corals, the host is a complex community of organisms, which includes the coral animal, symbiotic zooxanthellae, and microbial symbionts.

Scientific understanding of individual disease causes in corals remains very poor. Lack of identification of specific pathogens of many coral diseases has hindered the ecological understanding of diseases and the ability to manage them effectively. Several authors have suggested there is a link between increased incidence of coral disease with increased temperature (Bruno et al. 2007; Harvell et al. 1999; Muller et al. 2008; Patterson et al. 2002) that may make corals more prone to infection or make pathogens more potent. An increased prevalence of infectious disease outbreaks has been associated with thermal stress even at temperatures below those required to cause mass bleaching (Bruno et al. 2007). In addition, disease outbreaks have followed bleaching events (Brandt and McManus 2009) and hurricanes (Bruckner and Bruckner 1997; Halley et al. 2001; Miller and Williams 2007; Williams et al. 2008), indicating greater susceptibility to disease when corals are stressed.

4.2.1.5.4 Trophic Effects of Fishing

Fishing, particularly overfishing, can have large scale, long-term ecosystem-level effects that can change ecosystem structure from coral-dominated reefs to algal-dominated reefs called a ‘phase shift’ (Hughes 1994). Phase shifts can result when fishing removes species that are particularly important in structuring coral reef ecosystems (Mumby et al. 2007). Effects of fishing can include reducing population abundance of herbivorous fish species that control algal growth, limiting the size structure of fish populations, reducing species richness of herbivorous fish, and releasing corallivores from predator control. If herbivorous fish populations, particularly large-bodied parrotfish, are heavily fished and a major mortality of coral colonies occurs, then algae can grow rapidly and prevent the recovery of the coral population. The ecosystem may then collapse into an alternative stable state– a persistent phase shift in which algae replace corals as the dominant reef species (Mumby et al. 2007). Recent information shows that one of the most detrimental effects of unsustainable fishing pressure is the alteration of trophic interactions that are particularly important in structuring coral reef ecosystems (Jackson et al. 2012; Jackson et al.

2014; Ruppert et al. 2013). Although algae can have negative effects on adult coral colonies (i.e., overgrowth, bleaching from toxic compounds), the ecosystem-level effects of algae are primarily from inhibited coral recruitment. Filamentous algae can prevent the recruitment of coral larvae by creating sediment traps that obstruct access to a hard substrate for attachment. Additionally, macroalgae reduces coral recruitment through occupation of the available space, shading, abrasion, chemical poisoning, and infection with bacterial disease (Rasher et al. 2012; Rasher and Hay 2010; Rasher et al. 2011).
The trophic effects of fishing are likely to interact with many other threats. For example, when carnivorous fishes are overfished, corallivorous fish populations may increase, resulting in greater predation on corals (Burkepile and Hay 2007). Further, some corallivores are vectors of disease and can transmit disease from one coral colony to another as they transit and consume from each coral colony (Aeby and Santavy 2006). Increasing corallivore abundance results in transmittal of disease to higher proportions of the corals within the population.

4.2.1.5.5 Sedimentation

Human activities in coastal watersheds introduce sediment into the ocean by a variety of mechanisms; including river discharge, surface run-off, groundwater seeps, and atmospheric deposition. Elevated sediment levels are generated by poor land use practices and coastal and nearshore construction, including dredging. Nearshore sediment levels will also likely increase with sea level rise due to erosion at the shoreline and re-suspension of lagoonal sediments.

The most common direct effect of sedimentation is deposition of sediment on coral surfaces as it settles out from the water column. Corals with certain morphologies (e.g., mounding) can passively reject settling sediments or corals can actively displace sediment by ciliary action or mucous production, both of which require energetic expenditures (Bak and Elgershuizen 1976; Dallmeyer et al. 1982; Lasker 1980; Stafford-Smith 1993; Stafford-Smith and Ormond 1992). Corals that are unsuccessful in removing sediment will be smothered and die (Golbuu et al. 2003; Riegl and Branch 1995; Rogers 1983). Sediment can also induce sublethal effects, such as reductions in tissue thickness (Flynn et al. 2006) and excess mucus production (Marszalek 1981). In addition, suspended sediment can reduce the amount of light in the water column, making less energy available for coral photosynthesis and growth (Anthony and Hoegh Guldberg 2003; Bak 1978; Rogers 1979). While some corals may be more tolerant of short-term elevated levels of sedimentation, sediment stress and turbidity can induce bleaching (Philipp and Fabricius 2003; Rogers 1979). Finally, sediment impedes fertilization of spawned gametes (Gilmour 2002; Humphrey et al. 2008) and reduces larval settlement, as well as the survival of recruits and juveniles (Birrell et al. 2005; Fabricius et al. 2003).

Sedimentation is also likely to interact with many other threats. For example, when coral communities that are chronically affected by sedimentation experience a warming-induced bleaching event and associated disease outbreaks, the consequences for corals can be much more severe than in communities not affected by sedimentation.

4.2.1.5.6 Nutrients

Nutrients (e.g., nitrogen and phosphorous) are added to coral reefs from both point sources (readily identifiable inputs from a single source such as a pipe or drain) and non-point sources (inputs that occur over a wide area and are associated with particular land uses). Anthropogenic sources of nutrients include sewage, agricultural run-off, river and inlet discharges, and groundwater. Development of coastlines and destruction of mangrove forests compound the problem of anthropogenic nutrient runoff, as mangroves are able to filter massive amounts of nutrients and sediment caused by development. Natural processes bring nutrients to coral reefs as well, such as delivery of nutrient-rich deep water by internal waves and upwelling.

Elevated nutrients affect corals through 2 main mechanisms: direct impacts on coral physiology and indirect effects through nutrient-stimulation of other community components (e.g., macroalgae and filter feeders) that compete with corals for space on the reef. Coral reefs are adapted to low nutrient levels, and overabundance of nutrients can cause an imbalance that affects the entire ecosystem. Nutrient-rich water can enhance benthic algae and phytoplankton growth rates in coastal areas, resulting in overgrowth, competition, and algal blooms. Excess nutrient loads affect coral physiology and the balance between corals and their zooxanthellae (Szmant 2002). Increased nutrients can decrease calcification and reduce skeletal density. Either condition results in corals that are more prone to breakage or erosion. Increased levels of nutrients can also compromise coral health (Hodel and Vargas-Angel 2007). Notably, individual species have varying tolerance to increased nutrients.

Nutrients are likely to interact with many other threats. For example, when coral communities that are chronically affected by nutrients experience a warming-induced bleaching event and associated disease outbreaks, the consequences for corals can be much more severe than in communities not affected by nutrients. Additionally, experimental studies on diseased coral species indicate that nutrient augmentation adjacent to active disease lesions substantially increases disease severity (Bruno et al. 2003).

4.2.1.5.7 Sea Level Rise

Sea level rise may affect various coral life history events, including larval settlement, polyp development, and juvenile growth. It may also contribute to adult mortality and colony fragmentation, mostly due to increased sedimentation and decreased water quality (reduced light availability) caused by coastal inundation. The best available information suggests that sea level will continue to rise due to thermal expansion and the melting of land and sea ice. Many corals that inhabit the relatively narrow zone near the ocean surface have rapid growth rates when healthy, which allowed them to keep up with sea-level rise during the past periods of rapid climate change associated with de-glaciation and warming. However, depending on the rate and amount of sea level rise, rapid rises can lead to reef drowning. Rapid rises in sea level could affect many coral species by both submerging them below their common depth range and, more likely, by degrading water quality through coastal erosion and potentially severe sedimentation or enlargement of lagoons and shelf areas.

Rising sea level is likely to cause mixed responses in coral species depending on their depth preferences, sedimentation tolerances, and growth rates. Further, the nearshore topography can affect the impact sea level rise has on corals. Reductions in growth rate due to local stressors, bleaching, infectious disease, and ocean acidification may prevent the species from keeping up with sea level rise (e.g., from growing at a rate that will allow them to continue to occupy their preferred depth range despite sea-level rise). Additionally, lack of suitable new habitat, limited success in sexual recruitment, coastal runoff, and transition from natural to constructed shorelines will compound some corals' ability to survive rapid sea level rise.

4.2.1.5.8 Predation

Predation on some coral genera, including *Orbicella*, is a chronic, though occasionally acute, energy drain (Cole et al. 2008; Rotjan and Lewis 2008). Predators of Caribbean corals include snails, polychaete worms, and several species of fishes. The effects of chronic and frequent predation on corals are usually inconsequential but can become significant once the coral population decreases below a threshold. If the living coral cover is substantially reduced by natural or anthropogenic disturbances, the effects of predation become larger even if the rate of predation does not change. The increased focus of predation on the fewer remaining colonies causes the colony to use energy in defense and could result in a reduced rate of healing and/or fecundity or reduced resistance to stressors and/or disease. Additionally, corallivore populations can also increase due to removal of carnivorous predators (i.e., predators of the corallivores) through fishing. Over-predation can lead to significant coral declines when the rate of coral predation is higher than the rate of healing or coral population replenishment.

Predation is likely to interact with other threats. For instance, predation of coral colonies can increase the likelihood of coral disease infection, and likewise diseased colonies may be more likely to be preyed upon. Additionally, nutrient runoff from land stimulates phytoplankton blooms, which provide food for the larvae of invertebrate corallivores and can cause outbreaks of these predators (Birkeland 1982; Fabricius et al. 2010).

4.2.1.5.9 Toxins and Contaminants

Toxins and bioactive contaminants may be delivered to coral reefs via either point or non-point sources. The general effects of contaminants on coral communities are reductions in coral growth, coral cover, and coral species richness (Keller et al. 1991; Loya and Rinkevich 1980; Pait et al. 2007), and a shift in community composition to more tolerant species (Rachello-Dolmen and Cleary 2007). Contaminant effects are species specific and may have harmful effects in combination that would not be evident under experimental exposure to an individual substance.

Laboratory experiments have shown chemical contaminants are harmful to corals. However, linking coral decline to specific contaminants in the environment can be difficult. Low concentrations (parts per billion) of organic chemical contaminants including hydrocarbons (Negri and Heyward 2000), antifoulants (Knutson et al. 2012), pesticides (Negri and Heyward 2001), and metals such as copper, zinc, and iron (Bielmyer et al. 2010; Reichelt-Brushett and Harrison 2000; Reichelt-Brushett and Harrison 2005; Vijayavel et al. 2012) can impact physiological function at various life stages. Estrogen compounds at concentrations that occur in urban or sewage-affected coastal waters (i.e., 2 ng L^{-1}) can affect coral growth and fecundity (Tarrant et al. 2004). In lab experiments, various compounds found in common sunscreens caused coral bleaching (Danovaro et al. 2008). Both oil and chemical dispersants are toxic to coral larvae (Epstein et al. 2000; Negri and Heyward 2000; Goodbody-Gringley et al., unpublished data, K. Ritchie, Mote Marine Lab pers. comm. to A. Moulding, NMFS 2012). While toxic and biologically active substances impair corals, their effects are largely "silent," causing chronic and often sublethal stress or contributing to mortality of unapparent cause.

4.2.1.5.10 Physical Impacts

Coral reefs must endure physical damage from many different sources and threats acting over a range of spatial and temporal scales. Extreme wave events, such as those generated by severe tropical hurricanes, are naturally occurring processes that are typically viewed as acute disturbances. Direct physical effects from vessel groundings, anchor damage, and coastal construction activities, such as dredging, mining, and drilling, are somewhat analogous to storm damage in that they are relatively discrete events, although they generally occur over much smaller spatial scales than do storms. Other human-induced disturbances, such as those caused by tourism and recreational events, fishing gear, and marine debris, can have pervasive, chronic physical consequences. Chronic stresses reduce the ability of corals to recover from acute events (Connell et al. 1997). The relationships between injury interval and time required for reef recovery are the primary factors in evaluating equilibrium of the system (Connell 1978).

4.2.1.5.11 Threats Summary for Orbicella faveolata and Orbicella franksi

Because *Orbicella annularis* complex species have traditionally been common and are among the main reef builders in the Caribbean, they have been the frequent subject of research, including responses to and impacts of environmental threats. Published reports of individual bleaching surveys have consistently indicated that *O. faveolata* and the *Orbicella annularis* complex are highly-to-moderately susceptible to bleaching (Brandt 2009; Bruckner and Hill 2009; Oxenford et al. 2008; Wagner et al. 2010). Bleaching can prevent gamete production in *O. annularis* (Mendes and Woodley 2002) and *Orbicella annularis* complex colonies (Szmant and Gassman 1990) in the following reproductive season even after they recover normal pigmentation . Bleaching events leave permanent marks in coral growth records (Leder et al. 1991; Mendes and Woodley 2002). Particularly well-documented mortalities in these species following severe mass-bleaching in 2005 highlight the immense impact that thermal stress events and their aftermath can have on *Orbicella annularis* complex populations (Miller et al. 2009). Using demographic data collected in Puerto Rico over 9 years straddling the 2005 bleaching event, Hernández-Pacheco et al. (2011) showed that population growth rates of *O. annularis* were stable in the pre-bleaching period (2001-2005), but declined in the 2 years following the bleaching event. Simulation modeling of different bleaching probabilities predicted extinction of a population with these dynamics within 100 years at a bleaching probability between 10% and 20%; in other words, once every 5-10 years (Hernández-Pacheco et al. 2011). Cervino et al. (2004) also showed that higher temperatures (over experimental treatments from 20°C-31°C) resulted in faster rates of tissue loss and higher mortality in yellow-band affected *Orbicella annularis* complex. Recent work in the Mesoamerican reef system indicated that *Orbicella faveolata* had reduced thermal tolerances in many locations and over time (Carilli et al. 2010) with increasing human populations, implying increasing local threats (Carilli et al. 2009).

The only study conducted regarding the impact of acidification on this genus is a field study that did not find any change in *Orbicella faveolata* calcification in sampled colonies from the Florida Keys up through 1996 (Helmle et al. 2011). Preliminary experiments testing effects of acidification on fertilization and settlement success of *Orbicella annularis* complex (Albright et al., unpublished data) show results that are consistent with the significant impairments demonstrated for *Acropora palmata* (Albright et al. 2010).

Both Bruckner and Hill (2009) and Miller et al. (2009) demonstrated profound declines for *Orbicella annularis* complex from disease impacts, both with and without prior bleaching. Both white-plague and yellow-band diseases can invoke this type of population level decline. Disease outbreaks can persist for years in a population; *Orbicella annularis* colonies suffering from yellow-band in Puerto Rico in 1999 still manifested similar disease signs 4 years later, with a mean tissue loss of 60% (Bruckner and Bruckner 2006).

Orbicella annularis complex does not suffer from catastrophic outbreaks of predators. While *Orbicella annularis* complex can host large populations of corallivorous snails, they rarely display large feeding scars that are apparent on other coral prey, possibly related to differences in tissue characteristics or nutritional value (Baums et al. 2003). However, low-level predation can have interactive effects with other stressors. For example, predation by butterflyfish can serve as a vector to facilitate infection of *Orbicella faveolata* with black-band disease (Aeby and Santavy 2006). Parrotfishes are also known to preferentially target *Orbicella annularis* , *O. franski,* and *O. faveolata* in so-called "spot-biting," which can leave dramatic signs in some local areas (Bruckner et al. 2000; Rotjan and Lewis 2006). Chronic parrotfish biting can impede colony recovery from bleaching in *O. franksi* and *O. faveolata* (Rotjan et al. 2006). Although it is not predation per se, *Orbicella* colonies have often been infested by other pest organisms. Bio-eroding sponges (Ward and Risk 1977) and territorial damselfishes, *Stegastes planifrons*, can cause tissue loss and skeletal damage. Damselfish infestation of *Orbicella annularis* complex appears to have increased in areas where their preferred, branching coral habitat has declined because of loss of Caribbean acroporids (Precht et al. 2010).

Large, massive, long-lived colonies of *Orbicella annularis* complex lend themselves to retrospective studies of coral growth in different environments, so there is a relatively large amount known or inferred regarding relationships between water quality and *Orbicella annularis* complex growth and status. For example, Tomascik (1990) found an increasing average growth (linear extension) rate of *Orbicella annularis* complex with improving environmental conditions on fringing reefs in Barbados. Within the same study, Tomascik also found a general pattern of decreasing growth rates within the past 30 years at each of the 7 fringing reefs and contributed this decrease to the deterioration of water quality along the west coast of Barbados. Torres and Morelock (2002) noted a similar decline in *Orbicella annularis* complex growth at sediment-impacted reefs in Puerto Rico. Density and calcification rate increased from high to low turbidity and sediment load, while extension rate followed an inverse trend (Carricart-Ganivet and Merino 2001). Eakin et al. (1994) demonstrated declines in *Orbicella annularis* linear extension during periods of construction in Aruba. Downs et al. (2005) suggested that localized toxicant exposure may account for a localized mortality event of *Orbicella annularis* complex in Biscayne National Park. *Orbicella faveolata* had somewhat lesser sensitivity to copper exposure in laboratory assays than *Acropora cervicornis* and *Pocillopora damicornis* (Bielmyer et al. 2010). Nutrient-related runoff has also been deleterious to *Orbicella annularis* complex. Elevated nitrogen reduced respiration and calcification in *Orbicella annularis* and stimulated zooxanthellae populations (Marubini and Davies 1996). Elevated nutrients increased the rate of tissue loss in *Orbicella franksi* and *Orbicella faveolata* affected by yellow-band disease (Bruno et al. 2003). Chronic nutrient elevation can produce bleaching and partial mortality in *Orbicella* *annularis*, whereas anthropogenic dissolved organic carbon kills corals directly (Kuntz et al. 2005).

In the recently published final rule listing these species as threatened, NMFS summarized the best available scientific information on threats contributing to the extinction risk of these species, organized according to the listing factors in section 4 of the ESA.

NMFS concluded that *O. faveolata* is highly susceptible to ocean warming (ESA Factor E), disease (C), nutrients (A, E), ocean acidification (E), and sedimentation (A, E) and susceptible to trophic effects of fishing (A). These threats are expected to continue and increase into the future. In addition, the species is at heightened extinction risk due to inadequate existing regulatory mechanisms to address global threats (D).

NMFS concluded that *O. franksi* is susceptible to ocean warming (ESA Factor E), disease (C), sedimentation (A, E), nutrients (A, E), and ocean acidification (E) and susceptible to trophic effects of fishing (A). These threats are expected to continue and increase into the future. In addition, the species is at heightened extinction risk due to inadequate existing regulatory mechanisms to address global threats (D).

4.2.1.5.12 Threats Summary for Rough Cactus Coral

Rough cactus coral is susceptible to acute and subacute white plague. Dustan (1977) reported dramatic impacts from this disease to the population in the upper Florida Keys in the mid-1970s. He also reported that the rate of disease progression was positively correlated with water temperature and measured rates of disease progression up to 3 mm per day. In the recently published final rule listing these species as threatened, NMFS summarized the best available scientific information on threats contributing to the extinction risk of this species, organized according to the listing factors in section 4 of the ESA. NMFS concluded that *M. ferox* is highly susceptible to disease (ESA Factor C) and susceptible to ocean warming (ESA Factor E), acidification (E), trophic effects of fishing (A), nutrients (A, E), and sedimentation (A, E). These threats are expected to continue and increase into the future. In addition, the species is at heightened extinction risk due to inadequate existing regulatory mechanisms to address global threats (Factor D).

4.2.1.5.13 Summary – Coral Species' Vulnerabilities to Extinction

Orbicella faveolata has undergone major declines mostly due to warming-induced bleaching and disease. There is evidence of synergistic effects of threats for this species including disease outbreaks following bleaching events and reduced thermal tolerance due to chronic local stressors stemming from land-based sources of pollution. *Orbicella faveolata* is highly susceptible to a number of threats, and cumulative effects of multiple threats have likely contributed to its decline and exacerbate vulnerability to extinction. Despite high declines, the species is still common and remains one of the most abundant species on Caribbean reefs. Its life history characteristics of large colony size and long life span have enabled it to remain relatively persistent despite slow growth and low recruitment rates, thus moderating vulnerability to extinction. However, the buffering capacity of these life history characteristics is expected to decrease as colonies shift to smaller size classes as has been observed in locations in its range. Its absolute population abundance has been estimated as at least tens of millions of colonies in each of several locations including the Florida Keys, Dry Tortugas, and the U.S. Virgin Islands and is higher than the estimate from these three locations due to the occurrence of the species in many other areas throughout its range. Despite the large number of islands and environments that are included in the species' range, geographic distribution in the highly disturbed Caribbean exacerbates vulnerability to extinction because *O. faveolata* is limited to an area with high, localized human impacts and predicted increasing threats. Its depth range of 0.5 to at least 40 m, possibly up to 90 m, moderates vulnerability to extinction because deeper areas of its range will usually have lower temperatures than surface waters, and acidification is generally predicted to accelerate most in waters that are deeper and cooler than those in which the species occurs. *Orbicella faveolata* occurs in most reef habitats, including both shallow and mesophotic reefs, which moderates vulnerability to extinction because the species occurs in numerous types of reef environments that are predicted, on local and regional scales, to experience highly variable thermal regimes and ocean chemistry at any given point in time. Its abundance, life history characteristics, and depth distribution, combined with spatial variability in ocean warming and acidification across the species' range, moderate vulnerability to extinction because the threats are non-uniform, and there will likely be a large number of colonies that are either not exposed or do not negatively respond to a threat at any given point in time.

Orbicella franksi has undergone declines most likely from disease and warming-induced bleaching. There is evidence of synergistic effects of threats for this species including increased disease severity with nutrient enrichment. *Orbicella franksi* is highly susceptible to a number of threats, and cumulative effects of multiple threats have likely contributed to its decline and exacerbate vulnerability to extinction. Despite declines, the species is still common and remains one of the most abundant species on Caribbean reefs. Its life history characteristics of large colony size and long life span have enabled it to remain relatively persistent despite slow growth and low recruitment rates, thus moderating vulnerability to extinction. However, the buffering capacity of these life history characteristics is expected to decrease as colonies shift to smaller size classes as has been observed in locations in its range. Its absolute population abundance has been estimated as at least tens of millions of colonies in both a portion of the U.S. Virgin Islands and the Dry Tortugas and is higher than the estimate from these two locations due to the occurrence of the species in many other areas throughout its range. Despite the large number of islands and environments that are included in the species' range, geographic distribution in the highly disturbed Caribbean exacerbates vulnerability to extinction because *O. franksi* is limited to an area with high, localized human impacts and predicted increasing threats. Its depth range of five to at least 50 m, possibly up to 90 m, moderates vulnerability to extinction because deeper areas of its range will usually have lower temperatures than surface waters, and acidification is generally predicted to accelerate most in waters that are deeper and cooler than those in which the species occurs. *Orbicella franksi* occurs in most reef habitats, including both shallow and mesophotic reefs, which moderates vulnerability to extinction because the species occurs in numerous types of reef environments that are predicted, on local and regional scales, to experience highly variable thermal regimes and ocean chemistry at any given point in time. Its abundance, life history characteristics, and depth distribution, combined with spatial variability in ocean warming and acidification across the species' range, moderate vulnerability to extinction because the threats are non-uniform, and there will likely be a large number of colonies that are either not exposed or do not negatively respond to a threat at any given point in time.

Mycetophyllia ferox has declined due to disease in at least a portion of its range and has low recruitment, which limits its capacity for recovery from mortality events and exacerbates vulnerability to extinction. Despite the large number of islands and environments that are included in the species' range, geographic distribution in the highly disturbed Caribbean exacerbates vulnerability to extinction because rough cactus coral is limited to an area with high, localized human impacts and predicted increasing threats. Its depth range of five to 90 meters moderates vulnerability to extinction because deeper areas of its range will usually have lower temperatures than surface waters, and acidification is generally predicted to accelerate most in waters that are deeper and cooler than those in which the species occurs. Its habitat includes shallow and mesophotic reefs which moderates vulnerability to extinction because the species occurs in numerous types of reef environments that are predicted, on local and regional scales, to experience highly variable thermal regimes and ocean chemistry at any given point in time. Rough cactus coral is usually uncommon to rare throughout its range. Its absolute abundance has been estimated as at least hundreds of thousands of colonies in the Florida Keys and Dry Tortugas combined and is higher than the estimate from these two locations due to the occurrence of the species in many other areas throughout its range. Its abundance, combined with spatial variability in ocean warming and acidification across the species' range, moderate vulnerability to extinction because the threats are non-uniform, and there will likely be a large number of colonies that are either not exposed or do not negatively respond to a threat at any given point in time.

4.2.2 Johnson's Seagrass Designated Critical Habitat

NMFS designated Johnson's seagrass critical habitat on April 5, 2000 (65 FR 17786; see also, 50 CFR 226.2 13). The term "critical habitat" is defined in Section 3(5)(A) of the ESA as:

(i) The specific areas within the geographical area occupied by a species, at the time it is listed in accordance with the Act, on which are found those physical or biological features (I) essential to the conservation of the species and (II) that may require special management considerations or protection; and

(ii) specific areas outside the geographical area occupied by a species at the time it is listed, upon a determination that such areas are essential for the conservation of the species.

"Conservation" is defined in Section 3(3) of the ESA as the use of all methods and procedures that are necessary to bring any endangered or threatened species to the point at which listing under the ESA is no longer necessary.

Ten areas (units) within the range of Johnson's seagrass (approximately 200 km of coastline from Sebastian Inlet to northern Biscayne Bay, Florida) are designated as Johnson's seagrass critical habitat. The total acreage of critical habitat for Johnson's seagrass range wide is roughly 22,574 acres (NMFS 2002). The project site occurs in Unit J of NMFS-designated critical habitat. There are approximately 18,757 acres of designated critical habitat within Unit J (NMFS 2002). Unit J is by far the largest of the designated critical habitat units, making up approximately 83% of total designated critical habitat for Johnson's seagrass throughout its 200-km range.

Unit J is described in the final rule designating critical habitat for Johnson's seagrass (50 CFR Part 226) as follows:

> The northern boundary of Biscayne Bay Aquatic Preserve, NE 163rd Street, and including all parts of Biscayne Bay Aquatic preserve as defined in 1818.002 of the Florida Administrative Code (F.A.C) excluding the Oleta River, Miami River, and Little River beyond their mouths, the federally-marked navigational channels of the ICW, and all existing federally-authorized navigation channels, basins, and berths at the Port of Miami to the currently documented southernmost range of Johnson's seagrass, central Key Biscayne (25°45'N).

Critical habitat effects analyses determinations focus on those physical and biological features that are essential to the conservation of the species (50 CFR 424.12). Federal agencies must ensure that their activities are not likely to result in the destruction or adverse modification of critical habitat through adverse effects to the essential features within defined critical habitat areas. Therefore, proposed actions that may impact designated critical habitat require an analysis of potential impacts to each essential feature, and the consequences of such impacts to conservation of the species. The essential features of Johnson's seagrass critical habitat are (1) adequate water quality, defined as being free from nutrient over-enrichment by inorganic and organic nitrogen and phosphorous or other inputs that create low oxygen conditions; (2) adequate salinity levels, indicating a lack of very frequent or constant discharges of fresh or low salinity waters; (3) adequate water transparency which would allow sunlight necessary for photosynthesis; and (4) stable, unconsolidated sediments that are free from physical disturbance. All 4 essential features must be present in an area for it to function as critical habitat for Johnson's seagrass.

A total area of 0.59 acre of Johnson's seagrass critical habitat is present in the action area; however, we do not believe that the entire 0.59 acre area is functioning as critical habitat. According to the USACE, the project site bottom is primarily rock rubble and covered by man-made debris. Therefore, one of the essential features is missing in a large portion of the project site (i.e., stable, unconsolidated sediments). Thus, in our judgment, since the stable, unconsolidated sediment essential feature is absent, this portion of the project area is not functioning as critical habitat for Johnson's seagrass. We believe that only the portion of the project area containing existing seagrasses (0.13 acre) contains all of the essential features of the critical habitat.

5 Environmental Baseline

This section is a description of the effects of past and ongoing human and natural factors leading to the current status of the species, its habitat (including designated critical habitat), and ecosystem, within the action area.[6] The environmental baseline is a "snapshot" of a species'

---

[6] The action area is defined by regulation as "all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action" (50 CFR 402.02).

health at a specified point in time. It does not include the effects of the action under review in the consultation.

By regulation, environmental baselines for Opinions include the past and present impacts of all state, federal, or private actions and other human activities in the action area. We identify the anticipated impacts of all proposed federal projects in the specific action area of the consultation at issue, that have already undergone formal or early Section 7 consultation as well as the impact of state or private actions which are contemporaneous with the consultation in process (50 CFR 402.02).

Focusing on the impacts of the activities in the action area specifically, allows us to assess the prior experience and state (or condition) of the endangered and threatened individuals, and areas of designated critical habitat that occur in an action area, and that will be exposed to effects from the action under consultation. This is important because in some phenotypic states or life history stages, listed individuals will commonly exhibit, or be more susceptible to, adverse responses to stressors than they would be in other states, stages, or areas within their distributions. The same is true for localized populations of endangered and threatened species: the consequences of changes in the fitness or performance of individuals on a population's status depends on the prior state of the population. Designated critical habitat is no different: under some ecological conditions, the physical and biotic features of critical habitat will exhibit responses that they would not exhibit in other conditions.

5.1 Status of Listed Corals within the Action Area

Results from a survey conducted in the project area (Table 2) found boulder star, mountainous star, and rough cactus corals present on the existing bulkheads.

Table 2. Summary Data for Listed Corals in the Project Area

Species Name	**Number of Colonies**	**Colonies > 10 cm suitable for relocation**
Orbicella faveolata (Mountainous Star)	8	8
Orbicella franksi (Boulder Star)	1	1
Mycetophyllia ferox (Rough Cactus)	1	1

5.1.1 Factors Affecting Listed Corals within the Action Area

Coral colonies are non-motile and susceptible to relatively localized adverse effects as a result. Localized adverse effects to listed corals in the action area are likely from many of the same stressors affecting these species throughout their range, namely ocean warming, ocean acidification, disease, anthropogenic breakage and intense weather events (i.e., hurricanes and extreme cold-water disturbances). Prior to the recent listing of 5 new coral species in the Atlantic and Caribbean as threatened, NMFS completed a number of Section 7 consultations to address the effects of federal actions on elkhorn and staghorn corals, and when appropriate, authorized incidental take. Each of those consultations sought to minimize the adverse impacts of the action on elkhorn and staghorn corals. The summary below of federal actions and the effects of these actions includes only those federal actions in, or with effects within, the action area that have already concluded or are currently undergoing formal Section 7 consultation. These actions may also adversely affect mountainous star, boulder star, and rough cactus corals.

Federal Actions

Federal actions that may adversely affect listed corals in or near the action area include:

- **EPA and USACE-permitted discharges to surface waters and dredge-and-fill.** Shoreline and riparian disturbances (whether in the riverine, estuarine, marine, or floodplain environment) resulting in discharges may retard or prevent the reproduction, settlement, reattachment, and development of listed corals (e.g., land development and runoff, and dredging and disposal activities, result in direct deposition of sediment on corals, shading, and lost substrate for fragment reattachment or larval settlement). These activities can directly affect staghorn coral via fragmentation/breakage or abrasion. The activities may also affect listed coral species by physically altering or removing benthic habitat suitable for colonization. Dredge-and-fill activities may also cause increases in sedimentation that may cause shading, deposition of sediment onto coral colonies, and/or loss of substrate for fragment reattachment or larval settlement. The 1997 Regional Biological Opinion (RBO) on hopper dredge use for maintaining navigation channels in North Carolina through Key West, Florida, is currently undergoing a reinitiation of consultation due to the listing of staghorn and elkhorn coral, among other things.

- **EPA-regulated discharge of pollutants, such as oil, toxic chemicals, radioactivity, carcinogens, mutagens, teratogens, or organic nutrient-laden water, including sewage water, into the waters of the United States.** Elevated discharge levels may cause direct mortality, reduced fitness, or habitat destruction/modification. The EPA has been involved in ongoing litigation over the sufficiency of standards promulgated by the State of Florida to regulate discharges of nutrients into state waters, including habitats occupied by the listed corals. NMFS is engaged in consultation with the EPA regarding their approval of the state's standards.

Other Non-Federal Actions Affecting Listed Corals.

Poor boating and anchoring practices, as well as poor diving and snorkeling techniques cause abrasion and breakage of corals. Commercial and recreational vessel traffic can adversely affect listed corals through propeller scarring, propeller wash, and accidental groundings. Anthropogenic sources of marine pollution, while difficult to attribute to a specific federal, state, local, or private action, may indirectly affect corals in the action area. Sources of pollutants in the action area include atmospheric loading of pollutants such as PCBs, storm water runoff from coastal towns, and runoff into canals and rivers that empty into bays and groundwater. Nutrients, contaminants, and sediment from point and non-point sources cause direct mortality and the breakdown of normal physiological processes. Additionally, these stressors create an unfavorable environment for reproduction and growth.

Nutrient loading from land-based sources, such as coastal communities and agricultural operations, are known to have adverse effects on corals. Lapointe et al. (2004) directly linked wastewater discharges in the Florida Keys with adverse effects to the nearby coral reef communities. Within the past 6 years, offshore wastewater outfalls in nearby Broward County have been decommissioned, as part of implementation of Chapter 2008-232, Laws of Florida, which prohibits the construction of new domestic wastewater ocean outfalls, sets out a timeline for the elimination of existing domestic wastewater ocean outfalls by 2025, and requires that a majority of the wastewater previously discharged be beneficially reused. This law was enacted in part because of the adverse effects of effluent to corals.

Diseases have been identified as a major cause of coral decline. Although the most severe mortality resulted from an outbreak in the early 1980s, diseases (i.e., white-band disease) are still present in coral populations and continue to cause mortality.

Hurricanes and large coastal storms could also significantly harm corals. Due to its branching morphology, staghorn coral is especially susceptible to breakage from extreme wave action and storm surges. Historically, large storms potentially resulted in an asexual reproductive event, if the fragments encountered suitable substrate, attached, and grew into a new colony. By contrast, in the recent past, the amount of suitable substrate is significantly reduced; therefore, many fragments created by storms die. Hurricanes, if they do not result in heavy storm surge, are also sometimes beneficial during years with high sea surface temperatures as they lower the temperatures and provide fast relief to corals during periods of high thermal stress (Heron et al. 2008). Still, major hurricanes have caused significant losses in coral cover and changes in the physical structure of many reefs. According to the NOAA Historical Hurricane Tracks website, approximately, 29 hurricanes or tropical storms have impacted the area since records have been kept (1859-2013).

Several types of fishing gears used within the action area may adversely affect listed corals. Longline, other types of hook-and-line gear, and traps have all been documented as interacting with corals in general, though no data specific to listed corals are available. Available information suggests hooks and lines can become entangled in reefs, resulting in breakage and abrasion of corals. Traps have been found to be the most damaging; lost traps and illegal traps were found to result in greater impact to coral habitat because they cause continuous habitat damage until they degrade.

Conservation and Recovery Actions Benefiting Listed Corals

Research, restoration, and education and outreach activities, as part of the NMFS's ESA program, as well as through NOAA's Coral Reef Conservation Program (CRCP), are ongoing through the southeast region. NOAA's Restoration Center and state and territorial partners conduct grounding response and restoration activities throughout the U.S. jurisdictions. The summaries below discuss these measures in more detail.

Regulations Reducing Threats to Listed Corals

Numerous management mechanisms exist to protect corals or coral reefs in general. Prior to the ESA listing of corals, federal regulatory mechanisms and conservation initiatives were most beneficial to branching corals and have focused on addressing physical impacts, including damage from fishing gear, anchoring, and vessel groundings. In addition, the Coral Reef Conservation Act and the 2 Magnuson-Stevens Act Coral and Reef Fish Fishery Management Plans (Caribbean) require the protection of corals and prohibit the collection of hard corals. Depending on the specifics of zoning plans and regulations, marine protected areas (MPAs) can help prevent damage from collection, fishing gear, groundings, and anchoring.

The State of Florida regulates activities that involve and occur in coral reefs in Florida. Statutes and rules protect all corals from collection, commercial exploitation, and injury/destruction on the sea floor (FS 253.001, 253.04, Chapter 68B-42.008 and 68B-42.009), except as authorized by a Special Activity License for the purposed of research. Additionally, Florida has a comprehensive state regulatory program that regulates most land, including upland, wetland, and surface water alterations throughout the state.

5.2 Status of Johnson's Seagrass Designated Critical Habitat within the Action Are

The project site is located within Biscayne Bay adjacent to shoreline that is armored with seawalls. The action area supports manatee grass (*Syringodium filiforme*), shoal grass (*Halodule wrightii*), and turtle grass (*Thalassia testudinum*) within the slip area. No Johnson's seagrass was found within the action area.

Federal Actions

Although NMFS knows of no other projects that have occurred or are occurring in the action area, there are a wide range of activities funded, authorized, or carried out by federal agencies that may affect the essential habitat requirements of Johnson's seagrass critical habitat within the action area. These include channel dredging, dock/marina construction, boat shows, bridge/highway construction, residential construction, shoreline stabilization, and the installation of subaqueous lines or pipelines, which could all have impacts on water quality within Biscayne Bay. Other federal actions (or actions with a federal nexus) that may affect Johnson's seagrass critical habitat include actions to regulate vessel traffic by the U.S. Coast Guard; management of protected species and Biscayne National Park by the Department of Interior (USFWS and National Park Service); and authorization of state coastal zone management plans by NOAA's National Ocean Service. The USACE, in conjunction with the South Florida Water Management District, oversees freshwater discharges from Lake Okeechobee that flow downstream to Biscayne Bay, which have the potential to adversely affect salinity, turbidity, and water quality. The Comprehensive Everglades Restoration Plan (CERP) has developed an Environmental Impact Statement that addresses methods to help alleviate the frequency of high-volume freshwater discharges from Lake Okeechobee. The most clearly identified and manageable threat to the survival and recovery of Johnson's seagrass is the possibility of mortality due to reduced salinity over long periods of time. In addition, federally permitted dock construction and dredging may occur directly adjacent to the action area. These activities are on-going, as the shoreline is highly prized for residential development and mooring of deep-draft boats.

State or Private Actions

A number of non-federal activities that may adversely affect designated critical habitat for Johnson's seagrass in or adjacent to the action area include impacts from improperly-managed stormwater runoff and residential shoreline stabilization activities that do not obtain federal permits (e.g., seawall repair, riprap placement).

Biscayne Bay is a popular area for recreational boating and there are many shallow areas where seagrass is impacted by anchoring, prop dredging, and scarring. Many residences along the Bay have docks for mooring vessels. Some vessels are very large and have wide beams that cause shading of the substrate preventing seagrasses from acquiring sunlight. These vessels also create turbid conditions if they do not have adequate clearance under their hulls when operating in shallower depths.

Since the 1960s, urban development has affected inshore water quality throughout the range of Johnson's seagrass. Yet, Woodward-Clyde (1996) believed improvements in erosion and sediment control in association with urban development in the 1980s and 1990s may have been responsible for reduced turbidity in those decades as compared to the previous 2 decades of development. Reductions in seagrasses were apparent in the 1970s, along with areas of highly turbid water. Increases in submerged aquatic vegetation were noted until coverage and density peaked in 1986, albeit at levels remaining below those observed in the decades prior to 1960. In association with upland development, water quality and transparency within the range of Johnson's seagrass are affected by storm water and agricultural runoff, wastewater discharges, and other point and non-point source discharges.

Other Potential Sources of Impacts to the Environmental Baseline

Large-scale weather events, such as tropical storms and hurricanes, while they often generate runoff conditions that decrease water quality, also produce conditions (wind setup and abrupt water elevation changes) that can increase flushing rates. The effects of storms can be complex. Specifically documented storm effects on healthy seagrass meadows have been relatively minor and include: 1) scouring and erosion of sediments, 2) erosion of seeds and plants by waves, currents, and surge, 3) burial by shifting sand, 4) turbidity, and 5) discharge of freshwater, including inorganic and organic constituents in the effluents (Oppenheimer 1963, van Tussenbroek 1994; Whitfield et al. 2002; Steward et al. 2006). Storm effects may be chronic, e.g., due to seasonal weather cycles, or acute, such as the effects of strong thunderstorms or tropical cyclones. Studies have demonstrated that healthy, intact seagrass meadows are generally resistant to physical degradation from severe storms, whereas damaged seagrass beds may not be as resilient (Fonseca et al. 2000, Whitfield et al. 2002. Furthermore, despite evidence of longer-term reductions in salinity, increased water turbidity, and increased water color associated with higher than average precipitation in the spring of 2005, there was no evidence of long-term chronic impacts to seagrasses and no direct evidence of damage to Johnson's seagrass that could be considered a threat to the survival of the species (Steward et al. 2006).

State and Federal Activities That May Benefit Johnson's Seagrass Designated Critical Habitat

State and federal conservation measures exist to protect Johnson's seagrass habitat under an umbrella of management and conservation programs that address seagrasses in general (Kenworthy et al. 2006). Johnson's seagrass habitat is also included in the designation of critical habitat for the Florida manatee and is therefore subject to ESA Section 7 consultation by the USFWS, which has ESA jurisdiction over the manatee. These conservation measures must be continually monitored and assessed to determine if they will ensure the long-term protection of the species and the maintenance of environmental conditions suitable for its continued existence throughout its geographic distribution.

6 Effects of the Action

As described below, NMFS believes that the proposed action may adversely affect 3 recently listed species of coral and designated critical habitat for Johnson's seagrass. Because the action will result in adverse effects to these species, we must evaluate whether the action is likely to jeopardize the continued existence of any of these species or likely to cause destruction or adverse modification to critical habitat.

6.1 Effects of the Action on Coral Species

We believe the proposed project will adversely affect 3 coral species that were recently listed as threatened under the ESA (i.e., mountainous star coral, boulder star coral, and rough cactus coral). The USCG will be required to relocate 10 coral colonies that measure greater than or equal to 10 cm. Because all of the listed corals surveyed are greater than or equal to 10 cm, all of these colonies will be relocated to the coral nursery at the Miami Science Museum for use in culturing these species for eventual repopulation of natural reefs.

Even though the relocation of the coral colonies involves directed take (collection), the USCG has proposed the relocation because the effect to the species is significantly reduced as compared to the level of almost certain lethal take of the corals that would occur through installation of a new bulkhead. Relocations will result in: (1) a high likelihood of continued survival of the coral transplants, (2) the survival of the unique genetic material of the transplanted colonies, and (3) the potential for use of the material in future restoration activities. The Consultation Handbook (USFWS and NMFS 1998) expressly authorizes such directed take as an RPM (see page 4-53). Therefore, NMFS will evaluate the expected level of take through relocation so that these levels can be included in the evaluation of whether the proposed action will jeopardize the continued existence of the species.

Coral transplantation can successfully relocate colonies that would likely suffer injury or morality if not moved. Thornton et al. (2000) documented a 13% mortality rate for transplanted scleractinian corals in southeast Florida. The high rate of survival is attributed to the methods used and life history of corals. Lindahl (2003) showed that skilled handling does not significantly affect coral fragments or, by extension, coral colonies. Many different species of coral have shown high survival after transplantation, provided that colonies are handled with skill, are reattached properly, and the environmental conditions at the reattachment site are conducive to their growth (Maragos 1974; Birkeland et al. 1979; Harriott and Fisk 1988; Hudson and Diaz 1988; Guzman 1991; Kaly 1995; Becker and Mueller 1999; Tomlinson and Pratt 1999; Hudson 2000; Lindahl 2003; NCRI 2004).

NMFS agrees that all of the colonies of mountainous star, boulder star, and rough cactus coral could be lethally taken during installation of the new bulkhead if not relocated. Therefore, the USCG is proposing to relocate all of the colonies of listed corals over 10 cm, which happens to be all of the existing listed coral colonies found on the bulkhead. We believe coral transplantation will be highly successful and relocating these corals outside the project area is an appropriate alternative to the take that would otherwise occur. The corals will be transplanted to an approved coral nursery at the Miami Science Museum. Corals will be transplanted using the appropriate transplantation protocols (see Appendix A) by properly trained personnel. Because a suitable transplantation facility will accept these corals, and proper handling techniques are available and will be required, we have confidence that transplantation survival rates similar to those noted elsewhere will be likely in this case. We believe that the 13% coral morality rate described in the literature is a reasonable estimate for these corals being transplanted from their natural environment to nursery areas nearby.

In summary, a total of 10 colonies of coral will be relocated and 9 of those 10 will survive, as indicated in Table 3.

Table 3. Estimated Maximum Amount of Take of Coral Species

Coral Species	Number of colonies to be Relocated	Relocation Survival	Relocation Mortality
Mountainous star	8	7	1
Boulder star	1	1	0
Rough cactus	1	1	0
	10	9	1

6.2 Effects of the Project on Johnson's Seagrass Critical Habitat

There are several essential features of Johnson's seagrass critical habitat: (1) adequate water quality, defined as being free from nutrient over-enrichment by inorganic and organic nitrogen and phosphorous or other inputs that create low oxygen conditions; (2) adequate salinity levels, indicating a lack of very frequent or constant discharges of fresh or low salinity waters; (3) adequate water transparency which would allow sunlight necessary for photosynthesis; and (4) stable, unconsolidated sediments that are free from physical disturbance. We believe that the proposed project is likely to have the following effects on those essential features.

We believe up to 0.13 acre of Johnson's seagrass critical habitat will be adversely affected by the dredging of the slip. While the area to be dredged totals 0.59 acre, most of the bottom is comprised of rock rubble and manmade debris (e.g., automobile tires), making it unsuitable as critical habitat because it lacks the essential feature of stable, unconsolidated sediments. Seagrasses (not including Johnson's) are found within 0.13 acre of the area to be dredged, so we believe this area most likely contains all of the essential features. Therefore, we believe the proposed action will adversely affect 0.13 acre of Johnson's critical habitat by temporarily affecting the stable, unconsolidated sediments essential feature.

7 Cumulative Effects

Cumulative effects include the effects of *future* state, tribal, or local private actions—i.e., that are not already in the baseline—that are reasonably certain to occur in the action area considered in this Opinion. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to Section 7 of the ESA (50 CFR 402.14). Actions that are reasonably certain to occur would include actions that have some demonstrable commitment to their implementation, such as funding, contracts, agreements, or plans.

We could not identify any future actions that are reasonably certain to occur in the action area that would have effects beyond those already described in previous sections of this Opinion. The critical habitat located in the action area within Biscayne Bay will likely continue to experience the same types of actions that have affected this area of critical habitat in the past. Some of these threats may include boating activities (i.e., anchoring, propeller dredging), vessel mooring (i.e., shading impacts), and urban development. Urban development and associated runoff will continue to degrade water quality and decrease water clarity necessary for growth of seagrasses. Increased recreational vessel use will continue to result in shading impacts and physical scarring of critical habitat.

Within the action area, major future changes are not anticipated in addition to the ongoing human activities described in the environmental baseline. The present human uses of the action area, such as commercial shipping, are expected to continue, though some may occur at increased levels, frequency or intensity in the near future.

8 Jeopardy Analysis

The analyses conducted in the previous sections of this Opinion provide the basis on which we determine whether the proposed action would be likely to jeopardize the continued existence of coral species recently listed as threatened. In Section 6, we outlined how the proposed action would affect these species at the individual level and the magnitude of those effects based on the best available data. Next, we assess each of these species' response to the effects of the proposed action, in terms of overall population effects, and whether those effects will jeopardize their continued existence in the context of the status of the species (Section 4), the environmental baseline (Section 5), and the cumulative effects (Section 7).

It is the responsibility of the action agency to "insure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered species or threatened species…" (ESA Section 7(a)(2)). Action agencies must consult with and seek assistance from the NMFS to meet this responsibility. NMFS must ultimately determine in an Opinion whether the action jeopardizes listed species. To *jeopardize the continued existence of* is defined as "to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 CFR 402.02). The following jeopardy analysis first considers the effects of the action to determine if we would reasonably expect the action to result in reductions in reproduction, numbers, or distribution of listed coral species. The analysis next considers whether any such reduction would in turn result in an appreciable reduction in the likelihood of survival of these species in the wild, and the likelihood of recovery of these species in the wild.

Mountainous Star Coral (Orbicella faveolata)
The proposed action will not affect the species' current geographic range. Since relocated colonies will remain in the same area, no change in species distribution is anticipated. The species is common throughout U.S. waters of the western Atlantic and greater Caribbean, including Florida and the Gulf of Mexico. Within its range it is found within federally-protected waters in the Flower Garden Bank Sanctuary, Dry Tortugas National Park, Virgin Islands

National Park/Monument, Biscayne National Park, Florida Keys National Marine Sanctuary, Navassa National Wildlife Refuge, and the Buck Island Reef National Monument. The proposed action will not result in a reduction of mountainous star coral distribution or fragmentation of the range since we expect that mountainous star coral will persist within the action area on adjoining bulkheads and will continue to be capable of reproducing. Therefore, the distribution of this species will not be reduced.

There will be 1 lethal take of a mountainous star colony, and that constitutes a reduction in numbers of the species. This lost colony will not result in a reduction in reproduction of the species, since only one colony may be lost and the other relocated colonies will be used to proprogate additional colonies for transplantation.

There is ample evidence that mountainous star coral has declined dramatically throughout its range (but perhaps at a slower pace than its fast-paced Caribbean colleagues, elkhorn and staghorn corals [*Acropora palmata* and *A. cervicornis*]). The *Orbicella* complex has historically been a dominant species on Caribbean and Florida coral reefs, characterizing the so-called "buttress zone" and "annularis zone" in the classical descriptions of Caribbean reefs (Goreau 1959). Despite high declines, the species is still common and remains one of the most abundant species on Caribbean reefs. Its life history characteristics of large colony size and long life span have enabled it to remain relatively persistent despite slow growth and low recruitment rates, thus moderating vulnerability to extinction. However, the buffering capacity of these life history characteristics is expected to decrease as colonies shift to smaller size classes as has been observed in locations in its range. Nonetheless, its absolute population abundance has been estimated as at least tens of millions of colonies in each of several locations including the Florida Keys, Dry Tortugas, and the U.S. Virgin Islands and is higher than the estimate from these three locations due to the occurrence of the species in many other areas throughout its range. Near the action area of the proposed action, a 2011 survey conducted by Nova Southeastern University north of the project area (i.e., south of Port Everglades) has identified 4,030 colonies of mountainous star coral over just 735 acres. Therefore, we believe the loss of one colony of mountainous star coral by the proposed action will not reduce appreciably the likelihood of this species' survival in the wild.

A recovery plan has not been prepared yet for this species. Thus, we look at how the action may impact the species' extinction risk factors to determine whether the project will reduce the species' likelihood of recovery. In listing this species as threatened, NMFS concluded that *O. faveolata* is highly susceptible to ocean warming, disease, nutrients, ocean acidification, and sedimentation, and susceptible to trophic effects of fishing. In addition, the species is at heightened extinction risk due to inadequate existing regulatory mechanisms to address global threats. These threats are expected to continue and increase into the future, however, the proposed action will not worsen any of these threats. Further, the proposed action will not lessen any of the species' traits that mitigate its extinction risk, including its abundance, life history characteristics (large colony size, long life span), and depth distribution. The proposed project would not increase any of these threats. Therefore, NMFS believes that the proposed action is not likely to appreciably reduce the likelihood of mountainous star coral recovery in the wild.

Boulder Star Coral (Orbicella franksi)

The proposed action will relocate 1 colony of this species, and no mortality is anticipated. Therefore, there will be no reduction in numbers or reproduction of the species. Since the 1 relocated colony will remain in the same area, no change in species distribution is anticipated. The species is common throughout U.S. waters of the western Atlantic and greater Caribbean, including Florida and the Gulf of Mexico. Within its range it is found within federally-protected waters in the Flower Garden Bank Sanctuary, Dry Tortugas National Park, Virgin Islands National Park/Monument, Biscayne National Park, Florida Keys National Marine Sanctuary, Navassa National Wildlife Refuge, and the Buck Island Reef National Monument. The proposed action will not result in a reduction of boulder star coral distribution or fragmentation of the range since we expect that boulder star coral will persist within the action area on the adjoining bulkheads and will continue to be capable of reproducing. Because there will be no reduction in numbers, reproduction or distribution of this species as a result of the proposed action, the action will not reduce the species' likelihood of survival and recovery in the wild.

Rough Cactus Coral (Mycetophyllia ferox)
The proposed action will relocate 1 colony of this species, and no mortality is anticipated. Therefore, there will be no reduction in numbers or reproduction of the species. Since the 1 relocated colony will remain in the same area, no change in species distribution is anticipated. Rough cactus coral occurs throughout the U.S. waters of the western Atlantic but has not been reported from Flower Garden Banks (Hickerson et al. 2008). Within its range, it is found within federally-protected waters in the Dry Tortugas National Park, Virgin Islands National Park/Monument, Biscayne National Park, Florida Keys National Marine Sanctuary, Navassa National Wildlife Refuge, and the Buck Island Reef National Monument. The proposed action will not result in a reduction of rough cactus coral distribution or fragmentation of the range since we expect that rough cactus coral will persist within the action area on the adjoining bulkheads and will continue to be capable of reproducing. Therefore, the reproductive potential of the species in this portion of its range will persist. Because there will be no reduction in numbers, reproduction or distribution of this species as a result of the proposed action, the action will not reduce the species' likelihood of survival and recovery in the wild.

9 Analysis of Destruction or Adverse Modification of Designated Critical Habitat

This section analyzes the effects of this action, in the context of the status of the critical habitat, the environmental baseline, and cumulative effects, to determine whether its adverse effects are likely to destroy of adversely modify Johnson's seagrass critical habitat.

Critical habitat designates the physical and biological features (called "essential features") that are essential to the conservation of the species. When determining the potential impacts to critical habitat this Opinion does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR 402.02. Instead, we have relied upon the statutory provisions of the ESA to complete our critical habitat analysis. Ultimately, we determine if, under the proposed action, Johnson's seagrass critical habitat, and specifically Unit J, would remain functional (or retain the current ability for the essential features to be functionally established through natural processes) to serve the intended conservation role for the species. Generally speaking, recovery is a process involving a number of steps, including restoring a species' ecosystem. All species are a part of their own ecosystem. Thus, consideration of a proposed action's adverse effects on the essential features of critical habitat should include evaluating how those adverse effects may affect the species functioning within its ecosystem.

To evaluate what effect the proposed action may have on a species recovery and ecological function, we first review the species recovery plan, if available. The recovery plan for Johnson's seagrass indicates the species could be considered recovered and should be considered for delisting when the following conditions have been met: (1) the species' present geographic range remains stable for at least 10 years or increases, (2) self-sustaining populations are present throughout the range at distances less than or equal to the maximum dispersal distance to allow for stable vegetative recruitment and genetic diversity, and (3) populations and supporting habitat in its geographic range have long-term protection (through regulatory action or purchase acquisition).

In general, the ecological functions of seagrasses, including the seagrasses found on site, include nutrient recycling, detrital production and export, sediment stabilization, and provision of food and habitat for many stages of numerous marine species. Very little work has been done on the ecological functional value of Johnson's seagrass; however, it is likely to be similar to that of other *Halophila* spp. such as paddle grass. Limited observations suggest that Johnson's seagrass exploits unstable environments or newly-created unvegetated patches, with minimal resources allocated to the holding of space. Johnson's seagrass may quickly recruit to locally uninhabited patches and through prolific lateral branching and fast horizontal growth and move out once conditions become unfavorable. While these attributes may allow Johnson's seagrass to compete effectively in periodically disturbed areas such as shallow intertidal fringes, it may eventually be outcompeted by the larger-bodied seagrasses (Durako et al. 2003). Johnson's seagrass appears to fulfill the ecological function noted above for other seagrasses, but uses a strategy of maximizing growth over a large area until it becomes outcompeted by larger seagrasses, in lieu of putting its resources into competing for space it currently maintains. This strategy allows it to colonize unstable environments or newly-created unvegetated patches. In this respect, Johnson's seagrass is a colonizing seagrass species, fulfilling the broader ecological function of seagrasses in barren areas until larger-bodies seagrasses become established.

Based on the information provided in the Johnson's seagrass recovery plan and what we know about the ecological function of seagrasses, our destruction/adverse modification analysis now evaluates not only whether the adverse effects to the critical habitat essential features will impede achieving these recovery objectives, but also what impact the adverse effects might have on the species' ecological function.

The first recovery criterion for Johnson's seagrass is for its present range to remain stable for 10 years or to increase during that time. We believe the proposed action will not be an impediment to achieving this recovery criterion. We believe up to 0.13 acre of Johnson's seagrass critical habitat will be temporarily lost due to impacts from dredging. These effects will not reduce or destabilize the present range of Johnson's seagrass. Since 2006, annual monitoring in the southern portion of Johnson's seagrass range, which includes the project area, has shown little change in the species' frequency or abundance. There are thousands of additional, unaffected acres of critical habitat remaining contiguous and adjacent to the project site. In addition, in the northern range along the east coast of Florida, there is also abundant areas of Johnson's seagrass critical habitat that will be unaffected by this action.

The second recovery criterion for Johnson's seagrass requires that self-sustaining populations be present throughout the range at distances less than or equal to the maximum dispersal distance for the species. No Johnson's seagrass was documented at the project site; however, Johnson's seagrass has been documented nearby in Biscayne Bay during annual monitoring projects for consecutive years (FFWRI unpublished data). Drifting fragments of Johnson's seagrass can remain viable in the water column for 4-8 days (Hall et al. 2006), and can travel several kilometers under the influence of wind, tides, and waves. The temporary loss of the critical habitat associated with the proposed action would require fragments to reach suitable habitat. Since fragments can travel several kilometers and critical habitat abuts the action area on all sides, we believe the distance a fragment would have to travel in bypassing the project site will not affect its viability. The proposed action is not removing any Johnson's seagrass and hundreds of acres of critical habitat remain all around the project area upon which Johnson's seagrass fragments could settle. For these reasons, we believe the loss of critical habitat associated with the proposed action will not impede the recovery criterion requiring that self-sustaining populations be present throughout the range at distances less than or equal to the maximum dispersal distance for the species.

The final recovery criterion is for populations and supporting habitat in the geographic range of Johnson's seagrass to have long-term protection (through regulatory action or purchase acquisition). Though the affected parcel will not be available for the long-term, thousands of acres of designated critical habitat are still available for long-term protection (e.g., most areas of Biscayne Bay are open water and not adjacent to developed or developable land), which would include areas surrounding the action area. Therefore, we conclude that the proposed action's adverse effects on the essential features of Johnson's seagrass critical habitat will not impede achieving the recovery objectives listed above.

Our analysis now considers the proposed action's potential effects on Johnson's seagrasses' ecological function. We have described our understanding of the ecological function of Johnson's seagrass previously. Based on our review of the proposed action, we do not believe the proposed removal of Johnson's seagrass critical habitat will affect the species' capacity to conduct any of its ecological roles. Since Johnson's seagrass is not currently within the action area, the species is currently not providing any ecological function in the project footprint. Still, the dredging may cause a decrease in the density of the other species of seagrass that currently exist in the project footprint, thereby providing open space for colonization of Johnson's seagrass where there is suitable light transmittance. Since the dredging will restore the depth to its original depth of -10 ft mean low water (-8 ft plus 2 ft of allowable over-depth), which was the depth when Johnson's seagrass critical habitat was designated for the area, it will not adversely modify the designated critical habitat. In addition, it is likely that Johnson's seagrass will be able to colonize the area once the concentration of larger species of seagrasses is diminished. As Landry et al. (2008) noted, the competitive dominance of the larger species of seagrasses is diminished in recently-disturbed areas because Johnson's seagrass has been found to quickly colonize disturbed sites. Also, because Johnson's seagrass is found in abundance near the action area within Biscayne Bay, it will remain a source of nutrients and detritus with or without the loss of critical habitat anticipated within the action area. Likewise, Johnson's seagrass found in the adjacent areas will continue to retain the ability to stabilize sediments and provide food and habitat for many stages of numerous marine species elsewhere. Therefore, we conclude that the proposed action's adverse effects on the essential features of Johnson's seagrass critical habitat will not impede achieving the recovery objectives listed above nor will impede its ecological function.

10 Conclusion

Using the best available data, we analyzed the effects of the proposed action in the context of the status of the species, the environmental baseline, and cumulative effects, and determined that the proposed action is not likely to jeopardize the continued existence of Mountainous Star, Boulder Star and Rough Cactus corals. These analyses focused on the impacts to, and population responses of, these species. Because the proposed action will not appreciably reduce the likelihood of survival and recovery of these corals, it is our Opinion that the proposed action is not likely to jeopardize the continued existence of these species.

We have also analyzed the best available data on the status of Johnson's seagrass critical habitat, environmental baseline, effects of the proposed action, and cumulative effects to determine whether the proposed action is likely to destroy or adversely modify Johnson's seagrass critical habitat. We believe the proposed action will not affect the functioning of critical habitat to an extent that impedes recovery of the species. It is therefore our Opinion that the proposed action is not likely to destroy or adversely modify Johnson's seagrass critical habitat.

11 Incidental Take Statement

Section 9 of the ESA and federal regulations issued pursuant to Section 4(d) of the ESA prohibit take of endangered and threatened species, respectively, without special exemption. *Take* is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. *Incidental take* is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. The take of corals by the proposed action is not prohibited, as no section 4(d) rule has been promulgated.[7]

NMFS must estimate the extent of take expected to occur from implementation of the proposed action to frame the limits of the take exemption provided in the Incidental Take Statement. These limits set thresholds that, if exceeded, would be the basis for reinitiating consultation. The following section describes the extent of take that NMFS anticipates will occur as a result of implementing the proposed action. If actual take exceeds an amount (or geographic or temporal extent) specified here, re-initiation of consultation is required.

11.1 Extent of Anticipated Take – Corals

[7] Providing an exemption from section 9 liability is not the only important purpose of specifying take in an incidental take statement. *CBD v. Salazar*, 695 F.3d 893 (9th Cir. 2012). Though the *Salazar* case is not binding precedent for this action outside of the 9th Circuit, SERO finds the reasoning persuasive and is following the case out of an abundance of caution and anticipation the ruling will be more broadly followed in future cases.

Estimated Maximum Amount of Take of Coral Species

Coral Species	Number of colonies to be Relocated	Relocation Survival	Relocation Mortality
Mountainous star	8	7	1
Boulder star	1	1	0
Rough cactus	1	1	0
	10	9	1

Effect of the Take
NMFS has determined the anticipated take specified in Section 11.1 is not likely to jeopardize the continued existence of the affected coral species if the project is implemented as described in this Opinion.

12 Reasonable and Prudent Measures (RPMs)

Section 7(b)(4) of the ESA requires NMFS to issue a statement specifying the impact of any incidental take on listed species, which results from an agency action otherwise found to comply with Section 7(a)(2) of the ESA. It also states that the RPMs necessary to minimize the impacts of take and the terms and conditions to implement those measures must be provided and must be followed to minimize those impacts.

The RPMs and terms and conditions are specified as required by 50 CFR 402.12 (i)(1)(ii) and (iv) to document the incidental take by the proposed action and to minimize the impact of that take on the affected coral species. These measures and terms and conditions are non-discretionary, and must be implemented by the USCG, the USACE and/or a contractor. Failure to implement the terms and conditions will result in a need to reinitiate consultation. The USCG/USACE have a continuing duty to regulate the activity covered by this ITS. To monitor the impact of the incidental take, the USCG, the USACE and/or a contractor must report the progress of the action and its impact on the species to NMFS as specified in the ITS [50 CFR 402.12(i)(3)].

NMFS has determined that the following RPM is necessary and appropriate to minimize impacts of the incidental take of coral colonies during the proposed action. The following RPM and the associated term and condition are established to implement this measure, and to document incidental take. This requirement remains valid until reinitiation and conclusion of any subsequent Section 7 consultation.

1. The USCG/USACE must ensure that all established procedures involving coral relocation are followed and that all colonies of coral species that are over 10 centimeters are relocated to an approved coral nursery from the existing bulkheads prior to beginning construction of the new bulkheads.

13 Terms and Conditions

In order to minimize the impact of take and to implement the RPM, USCG/USACE must comply with the following term and condition. This term and condition is nondiscretionary.

1. Relocation of coral species: Since transplantation can be stressful on corals and the natural environment is variable, we believe the best way to minimize stress and ensure the survival of all transplanted colonies is to follow the established protocol (see Appendix A). Qualified individuals following the protocols in Appendix A must conduct transplantation. The USCG/USACE must ensure that all transplanted colonies are relocated to suitable habitat at the approved coral nursery located at the Miami Science Museum. (RPM 1)

14 Conservation Recommendations

NMFS believes the following conservation recommendations are reasonable, necessary, and appropriate to conserve and recover Johnson's seagrass. NMFS strongly recommends that these measures be considered and adopted.

1. NMFS recommends that a report of all current and proposed USACE projects in the range of Johnson's seagrass be prepared and used by the USACE to assess impacts on the species from these projects, to assess cumulative impacts, and to assist in early consultation that will avoid and/or minimize impacts to Johnson's seagrass and its critical habitat. Information in this report should include location and scope of each project and identify the federal lead agency for each project. The information should be made available to NMFS.

2. NMFS recommends that the USACE conduct and support research to assess trends in the distribution and abundance of Johnson's seagrass. Data collected should be contributed to the Florida Fish and Wildlife Conservation Commission's Florida Wildlife Research Institute to support ongoing GIS mapping of Johnson's and other seagrass distribution.

3. NMFS recommends that the USACE, in coordination with seagrass researchers and industry, support ongoing research on light requirements and transplanting techniques to preserve and restore Johnson's seagrass, and on collection of plants for genetics research, tissue culture, and tissue banking.

4. NMFS recommends that the USACE prepare an assessment of the effects of other actions under its purview on Johnson's seagrass for consideration in future consultations.

5. NMFS recommends that the USACE promote the use of the October 2002, *Key for Construction Conditions for Docks or other Minor Structures Constructed in or over Johnson's Seagrass* as the standard construction methodology for proposed docks located in the range of Johnson's seagrass.

6. NMFS recommends that the USACE review and implement the recommendations in the July 2008 report, *The Effects of Docks on Seagrasses, With Particular Emphasis on the Threatened Seagrass, Halophila johnsonii* (Landry et al. 2008).

7. NMFS recommends that the USACE review and implement the Conclusions and Recommendations in the October 2008 report, *Evaluation of Regulatory Guidelines to Minimize Impacts to Seagrasses from Single-Family Residential Dock Structures in Florida and Puerto Rico* (Shafer et al. 2008).

In order to keep NMFS informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, NMFS requests notification of the implementation of any conservation recommendations.

15 Reinitiation of Consultation

As provided in 50 CFR Section 402.16, reinitiation of formal consultation is required where discretionary federal agency involvement or control over the action has been retained (or is authorized by law) and if (1) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered, (2) the identified action is subsequently modified in a manner that causes an effect to listed species or critical habitat that was not considered in the Biological Opinion, or (3) a new species is listed or critical habitat designated that may be affected by the identified action.

16 Literature Cited

Aeby, G. S., and D. L. Santavy. 2006. Factors affecting susceptibility of the coral *Montastraea faveolata* to black-band disease. Marine Ecology Progress Series 318:103-110.

Albright, R., B. Mason, and C. Langdon. 2008. Effect of aragonite saturation state on settlement and post-settlement growth of *Porites astreoides* larvae. Coral Reefs 27(3):485-490.

Albright, R., B. Mason, M. Miller, and C. Langdon. 2010. Ocean acidification compromises recruitment success of the threatened Caribbean coral *Acropora palmata*. Proceedings of the National Academy of Sciences 107(47):20400-20404.

Alvarado-Chacon, E. M., and A. Acosta. 2009. Population size-structure of the reef-coral *Montastraea annularis* in two contrasting reefs of a marine protected area in the southern Caribbean Sea. Bulletin of Marine Science 85(1):61-76.

Alvarez-Filip, L., N. K. Dulvy, J. A. Gill, I. M. Côté, and A. R. Watkinson. 2009. Flattening of Caribbean coral reefs: region-wide declines in architectural complexity. Proceedings of the Royal Society B: Biological Sciences 276(1669):3019-3025.

Anthony, K. R. N., and O. Hoegh Guldberg. 2003. Variation in coral photosynthesis, respiration and growth characteristics in contrasting light microhabitats: an analogue to plants in forest gaps and understoreys? Functional Ecology 17(2):246-259.

Anthony, K. R. N., and coauthors. 2011. Ocean acidification and warming will lower coral reef resilience. Global Change Biology 17:1798–1808.

Aronson, R. B., and W. F. Precht. 2001. White-band disease and the changing face of Caribbean coral reefs. Hydrobiologia 460(1-3):25-38.

Baggett, L. S., and T. J. Bright. 1985. Coral recruitment at the East Flower Garden Reef (Northwestern Gulf of Mexico). Pages 379-384 *in* Proceedings 5th International Coral Reef Congress, volume 4, Tahiti, Polynesia.

Baird, A. H., J. R. Guest, and B. L. Willis. 2009. Systematic and biogeographical patterns in the reproductive biology of scleractinian corals. Annual Review of Ecology, Evolution, and Systematics 40:531-571.

Bak, R. P. M. 1978. Lethal and sublethal effects of dredging on reef corals. Marine Pollution Bulletin 9(1):14-16.

Bak, R. P. M., and S. R. Criens. 1982. Survival after fragmentation of colonies of *Madracis mirabilis*, *Acropora palmata* and *A. cervicornis* (Scleractinia) and the subsequent impact of a coral disease. Pages 221-227 *in* E. D. Gomez, and coeditors, editors. Proceedings of the Fourth International Coral Reef Symposium, Manila, Philippines.

Bak, R. P. M., and J. H. B. W. Elgershuizen. 1976. Patterns of oil-sediment rejection in corals. Marine Biology 37(2):105-113.

Bak, R. P. M., and M. S. Engel. 1979. Distribution, abundance and survival of juvenile hermatypic corals (Scleractinia) and the importance of life history strategies in the parent coral community. Marine Biology 54(4):341-352.

Bak, R. P. M., and B. E. Luckhurst. 1980. Constancy and change in coral reef habitats along depth gradients at Curacao. Oecologia 47(2):145-155.

Bates, N. R., A. Amat, and A. J. Andersson. 2009. The interaction of ocean acidification and carbonate chemistry on coral reef calcification: evaluating the carbonate chemistry Coral Reef Ecosystem Feedback (CREF) hypothesis on the Bermuda coral reef. Biogeosciences Discussions 6:7627-7672.

Baums, I. B., C. R. Hughes, and M. E. Hellberg. 2005. Mendelian microsatellite loci for the Caribbean coral Acropora palmata. Marine Ecology Progress Series 288:115-127.

Baums, I. B., M. E. Johnson, M. K. Devlin-Durante, and M. W. Miller. 2010. Host population genetic structure and zooxanthellae diversity of two reef-building coral species along the Florida Reef Tract and wider Caribbean. Coral Reefs 29:835–842.

Baums, I. B., M. W. Miller, and M. E. Hellberg. 2006. Geographic Variation in Clonal Structure in a Reef-building Caribbean Coral, Acropora palmata. Ecological Monographs 76(4):503-519.

Baums, I. B., M. W. Miller, and A. M. Szmant. 2003. Ecology of a corallivorous gastropod, Coralliophila abbreviata, on two scleractinian hosts. II. Feeding, respiration and growth. Marine Biology 142(6):1093-1101.

Becker, L. C., and E. Mueller. 2001. The culture, transplantation and storage of Montastraea faveolata, Acropora cervicornis and Acropora palmata: What we have learned so far. Bulletin of Marine Science 69(2):881-896.

Bielmyer, G. K., and coauthors. 2010. Differential effects of copper on three species of scleractinian corals and their algal symbionts (Symbiodinium spp.). Aquatic Toxicology 97(2):125-133.

Birkeland, C. 1977. The importance of rate of biomass accumulation in early successional stages of benthic communities to the survival of coral recruits. Pages 15-21 *in*, volume 1. Proc 3rd Intl Coral Reef Symp.

Birkeland, C. 1982. Terrestrial runoff as a cause of outbreaks of *Acanthaster planci* (Echinodermata: Asteroidea). Marine Biology 69(2):175-185.

Birrell, C. L., L. J. McCook, and B. L. Willis. 2005. Effects of algal turfs and sediment on coral settlement. Marine Pollution Bulletin 51(1-4):408-414.

Brainard, R. E., and coauthors. 2011a. Status review report of 82 candidate coral species petitioned under the U.S. Endangered Species Act. U.S. Dep. Commer.

Brainard, R. E., and coauthors. 2011b. Status review report of 82 candidate coral species petitioned under the U.S. Endangered

Species Act. U.S. Dep. Commer.

Brandt, M. E. 2009. The effect of species and colony size on the bleaching response of reef-building corals in the Florida Keys during the 2005 mass bleaching event. Coral Reefs 28(4):911-924.

Brandt, M. E., and J. W. McManus. 2009. Disease incidence is related to bleaching extent in reef-building corals. Ecology 90(10):2859-2867.

Bruckner, A., R. Bruckner, and P. Sollins. 2000. Parrotfish predation on live coral:"spot biting" and "focused biting". Coral Reefs 19(1):50-50.

Bruckner, A. W., editor. 2002a. Proceedings of the Caribbean Acropora Workshop: Potential Application of the U.S. Endangered Species Act as a Conservation Strategy. NOAA Technical Memorandum NMFS-OPR-24, Silver Spring, MD.

Bruckner, A. W. 2002b. Proceedings of the Caribbean Acropora workshop: Potential application of the US Endangered Species Act as a conservation strategy, volume 24. NOAA Office of Protected Resources, Silver Spring, MD.

Bruckner, A. W., and R. J. Bruckner. 1997. Outbreak of coral disease in Puerto Rico. Coral Reefs 16(4):260-260.

Bruckner, A. W., and R. J. Bruckner. 2006. Consequences of yellow band disease (YBD) on Montastraea annularis (species complex) populations on remote reefs off Mona Island, Puerto Rico. Diseases Of Aquatic Organisms 69(1):67-73.

Bruckner, A. W., and R. L. Hill. 2009. Ten years of change to coral communities off Mona and Desecheo Islands, Puerto Rico, from disease and bleaching. Diseases Of Aquatic Organisms 87(1-2):19-31.

Bruno, J. F., L. E. Petes, C. Drew Harvell, and A. Hettinger. 2003. Nutrient enrichment can increase the severity of coral diseases. Ecology Letters 6(12):1056-1061.

Bruno, J. F., and coauthors. 2007. Thermal stress and coral cover as drivers of coral disease outbreaks. PLoS Biology 5(6):e124.

Budd, A. F., H. Fukami, N. D. Smith, and N. Knowlton. 2012. Taxonomic classification of the reef coral family Mussidae (Cnidaria: Anthozoa: Scleractinia). Zoological Journal of the Linnean Society 166(3):465-529.

Burkepile, D. E., and M. E. Hay. 2007. Predator release of the gastropod *Cyphoma gibbosum* increases predation on gorgonian corals. Oecologia 154(1):167-173.

Caldeira, K., and M. E. Wickett. 2003. Anthropogenic carbon and ocean pH. Nature 425(6956):365-365.

Carilli, J. E., R. D. Norris, B. Black, S. M. Walsh, and M. McField. 2010. Century-scale records of coral growth rates indicate that local stressors reduce coral thermal tolerance threshold. Global Change Biology 16(4):1247-1257.

Carilli, J. E., R. D. Norris, B. A. Black, S. M. Walsh, and M. McField. 2009. Local stressors reduce coral resilience to bleaching. PLoS ONE 4(7):e6324.

Carricart-Ganivet, J. P., and M. Merino. 2001. Growth responses of the reef-building coral Montastraea annularis along a gradient of continental influence in the southern Gulf of Mexico. Bulletin of Marine Science 68(1):133-146.

Cervino, J. M., and coauthors. 2004. Relationship of Vibrio species infection and elevated temperatures to yellow blotch/band disease in Caribbean corals. Applied and Environmental Microbiology 70(11):6855-6864.

Cohen, A. L., D. C. McCorkle, and S. de Putron. 2007. The impact of seawater saturation state on early skeletal development in larval corals: insights into scleractinian biomineralization. Proceedings of the American Geophysical Union 2007 Fall Meeting.

Cohen, A. L., D. C. McCorkle, S. de Putron, G. A. Gaetani, and K. A. Rose. 2009. Morphological and compositional changes in the skeletons of juvenile corals reared in acidified seawater: Insights into the biomineralization response to ocean acidification. Geochemistry Geophysics Geosystems 10:Q07005.

Cole, A. J., M. S. Pratchett, and G. P. Jones. 2008. Diversity and functional importance of coral-feeding fishes on tropical coral reefs. Fish and Fisheries 9(3):286-307.

Colella, M. A., R. R. Ruzicka, J. A. Kidney, J. M. Morrison, and V. B. Brinkhuis. 2012. Cold-water event of January 2010 results in catastrophic benthic mortality on patch reefs in the Florida Keys. Coral Reefs.

Connell, J. H. 1978. Diversity in tropical rain forests and coral reefs. Science 199(4335):1302-1310.

Connell, J. H., T. P. Hughes, and C. C. Wallace. 1997. A 30-year study of coral abundance, recruitment, and disturbance at several scales in space and time. Ecological Monographs 67(4):461-488.

Dallmeyer, D. G., J. W. Porter, and G. J. Smith. 1982. Effects of particulate peat on the behavior and physiology of the Jamaican reef-building coral Montastrea annularis. Marine Biology 68(3):229-233.

Danovaro, R., and coauthors. 2008. Sunscreens cause coral bleaching by promoting viral infections. Environmental Health Perspectives 116(4):441-447.

Davis, G. E. 1977. Anchor damage to a coral reef on the coast of Florida. Biological Conservation 11(1):29-34.

Davis, G. E. 1982. A century of natural change in coral distribution at the Dry Tortugas: A comparison of reef maps from 1881 and 1976. Bulletin of Marine Science 32(2):608-623.

De Putron, S., D. McCorkle, A. Cohen, and A. Dillon. 2010. The impact of seawater saturation state and bicarbonate ion concentration on calcification by new recruits of two Atlantic corals. Coral Reefs:1-8.

Dean, R. J., and M. J. Durako. 2007. Carbon sharing through physiological integration in the threatened seagrass Halophila Johnsonii. Bulletin of Marine Science 81(1):21-35.

Doney, S., V. Fabry, R. Feely, and J. Kleypas. 2009. Ocean acidification: the other CO_2 problem. Annual Review of Marine Science 1.

Downs, C. A., and coauthors. 2005. Cellular diagnostics and coral health: Declining coral health in the Florida Keys. Marine Pollution Bulletin 51(5-7):558-569.

Dupont, J., W. Jaap, and P. Hallock. 2008. A retrospective analysis and comparative study of stony coral assemblages in Biscayne National Park, FL (1977–2000). Caribbean Journal of Science 44(3):334–344.

Dustan, P. 1977. Vitality of reef coral populations off Key Largo, Florida: recruitment and mortality. Environmental Geology 2(1):51-58.

Dustan, P., and J. C. Halas. 1987. Changes in the reef-coral community of Carysfort Reef, Key Largo, Florida: 1974 to 1982. Coral Reefs 6(2):91-106.

Eakin, C. M., J. S. Feingold, and P. W. Glynn. 1994. Oil refinery impacts on coral reef communities in Aruba, N.A. Pages 139-145 *in* R. N. Ginsberg, editor. Proceedings of the Colloquium on Global Aspects of Coral Reefs: Health, Hazards and History, 1993. University of Miami, Miami, FL.

Edmunds, P. J., and R. Elahi. 2007. The demographics of a 15-year decline in cover of the Caribbean reef coral *Montastraea annularis*. Ecological Monographs 77(1):3-18.

Epstein, N., R. P. M. Bak, and B. Rinkevich. 2000. Toxicity of third generation dispersants and dispersed Egyptian crude oil on Red Sea coral larvae. Marine Pollution Bulletin 40(6):497-503.

Fabricius, K., K. Okaji, and G. De'ath. 2010. Three lines of evidence to link outbreaks of the crown-of-thorns seastar Acanthaster planci to the release of larval food limitation. Coral Reefs 29(3):593-605.

Fabricius, K. E., C. Wild, E. Wolanski, and D. Abele. 2003. Effects of transparent exopolymer particles and muddy terrigenous sediments on the survival of hard coral recruits. Estuarine, Coastal and Shelf Science 57(4):613-621.

Fabry, V. J. 2008. Marine calcifiers in a high-CO_2 ocean. Science 320:1020-1022.

Fisk, D. A., and V. J. Harriott. 1990. Spatial and temporal variation in coral recruitment on the Great Barrier Reef: Implications for dispersal hypotheses. Marine Biology 107(3):485-490.

Flynn, A., S. Rotmann, and C. Sigere. 2006. Long-term monitoring of coral reefs subject to sediment stress in Papua New Guinea. Pages 286-292 *in* Proceedings of the 10th International Coral Reef Symposium, Okinawa, Japan.

Foster, N. L., I. B. Baums, and P. J. Mumby. 2007. Sexual vs. asexual reproduction in an ecosystem engineer: the massive coral *Montastraea annularis*. Journal of Animal Ecology 76(2):384-391.

Fukami, H., and coauthors. 2004. Geographic differences in species boundaries among members of the *Montastraea annularis* complex based on molecular and morphological markers. Evolution 58(2):324-337.

Gilmore, M. D., and B. R. Hall. 1976. Life history, growth habits, and constructional roles of Acropora cervicornis in the patch reef environment. JOURNAL OF SEDIMENTARY RESEARCH 46(3):519-522.

Gilmour, J. P. 2002. Acute sedimentation causes size-specific mortality and asexual budding in the mushroom coral, Fungia fungites. Marine and Freshwater Research 53(4):805-812.

Ginsburg, R. N., and J. C. Lang, editors. 2003. Status of coral reefs in the western Atlantic: Results of initial surveys, Atlantic and Gulf Rapid Reef Assessment(AGRRA) program, volume 496.

Gladfelter, E. H., R. K. Monahan, and W. B. Gladfelter. 1978. Growth rates of five reef-building corals in the northeastern Caribbean. Bulletin of Marine Science 28(4):728-734.

Gleason, D. F., B. S. Danilowicz, and C. J. Nolan. 2009. Reef waters stimulate substratum exploration in planulae from brooding Caribbean corals. Coral Reefs 28(2):549-554.

Golbuu, Y., S. Victor, E. Wolanski, and R. H. Richmond. 2003. Trapping of fine sediment in a semi-enclosed bay, Palau, Micronesia. Estuarine, Coastal and Shelf Science 57(5-6):941-949.

Goldberg, W. M. 1973. The ecology of the coral octocoral communities off the southeast Florida coast: geomorphology, species composition and zonation. Bulletin of Marine Science 23:465-488.

Goreau, N. I., T. J. Goreau, and R. L. Hayes. 1981. Settling, survivorship and spatial aggregation in planulae and juveniles of the coral *Porites porites* (Pallas). Bulletin of Marine Science 31(2):424-435.

Goreau, T. F. 1959. The ecology of Jamaican coral reefs I. Species composition and zonation. Ecology 40(1):67-90.

Goreau, T. F., and J. W. Wells. 1967. The shallow-water Scleractinia of Jamaica: revised list of species and their vertical distribution range. Bulletin of Marine Science 17(2):442-453.

Graham, E. M., A. H. Baird, and S. R. Connolly. 2008. Survival dynamics of scleractinian coral larvae and implications for dispersal. Coral Reefs 27(3):529-539.

Hall, L. M., M. D. Hanisak, and R. W. Virnstein. 2006. Fragments of the seagrasses *Halodule wrightii* and *Halophila johnsonii* as potential recruits in Indian River Lagoon, Florida. Marine Ecology Progress Series 310:109-117.

Halley, R. B., C. T. Reich, and T. D. Hickey. 2001. Coral reefs in Honduras: Status after Hurricane Mitch, USGS Open File Report 01-133.

Harrington, L., K. Fabricius, G. De'ath, and A. Negri. 2004. Recognition and selection of settlement substrata determine post-settlement survival in corals. Ecology 85(12):3428-3437.

Harriott, V. J. 1985. Mortality rates of scleractinian corals before and during a mass bleaching event. Marine Ecology Progress Series 21(1):81-88.

Harvell, C. D., and coauthors. 1999. Emerging marine diseases--climate links and anthropogenic factors. Science 285(5433):1505.

Helmle, K. P., R. E. Dodge, P. K. Swart, D. K. Gledhill, and C. M. Eakin. 2011. Growth rates of Florida corals from 1937 to 1996 and their response to climate change. Nature Communications 2:215.

Hernández-Pacheco, R., E. A. Hernández-Delgado, and A. M. Sabat. 2011. Demographics of bleaching in a major Caribbean reef-building coral: Montastraea annularis. Ecosphere 2(1):art 9.

Hickerson, E. L., G. P. Schmahl, M. Robbart, W. F. Precht, and C. Caldow. 2008. The state of coral reef ecosystems of the Flower Garden Banks, Stetson Bank, and other banks in the northwestern Gulf of Mexico. Pages 189–217 *in* J. E. Waddell, and A. M. Clarke, editors. The state of coral reef ecosystems of the United States and Pacific Freely Associated States: 2008. NOAA/National Centers for Coastal Ocean Science, Silver Spring, MD.

Hodel, E., and B. Vargas-Angel. 2007. Histopathological Assessment and Comparison of Sedimentation and Phosphate Stress in the Caribbean Staghorn Coral, Acropora cervicornis. Microscopy and Microanalysis 13(S02):220-221.

Hubbard, D. K., and D. Scaturo. 1985. Growth rates of seven species of scleractinean corals from Cane Bay and Salt River, St. Croix, USVI. Bulletin of Marine Science 36(2):325-338.

Hubbard, J., and Y. Pocock. 1972. Sediment rejection by recent scleractinian corals: a key to palaeo-environmental reconstruction. Geologische Rundschau 61(2):598-626.

Hughes, T. P. 1985. Life Histories and Population Dynamics of Early Successional Corals. Pages 101-106 *in* C. Gabrie, and B. Salvat editors. Proceedings of the 5th International Coral Reef Congress, Tahiti, French Polynesia.

Hughes, T. P. 1994. Catastrophes, phase shifts, and large-scale degradation of a Caribbean coral reef. Science 265(5178):1547-1551.

Hughes, T. P., and J. B. C. Jackson. 1985. Population-Dynamics and Life Histories of Foliaceous Corals. Ecological Monographs 55(2):141-166.

Hughes, T. P., and J. E. Tanner. 2000. Recruitment failure, life histories, and long-term decline of Caribbean corals. Ecology 81(8):2250-2263.

Humphrey, C., M. Weber, C. Lott, T. Cooper, and K. Fabricius. 2008. Effects of suspended sediments, dissolved inorganic nutrients and salinity on fertilisation and embryo development in the coral Acropora millepora (Ehrenberg, 1834). Coral Reefs 27(4):837-850.

Huntington, B. E., M. Karnauskas, and D. Lirman. 2011. Corals fail to recover at a Caribbean marine reserve despite ten years of reserve designation. Coral Reefs 30(4):1077-1085.

Idjadi, J. A., and coauthors. 2006. Rapid phase-shift reversal on a Jamaican coral reef. Coral Reefs 25(2):209-211.

IPCC. 2013. Working Group I Contribution to the IPCC Fifth Assessment Report (AR5), Climate Change 2013: The Physical Science Basis. Technical Summary - Final Draft Underlying Scientific-Technical Assessment, Stockholm.

IUCN. 2010. IUCN Red List of Threatened Species. Version 3.1. Page ii + 30 pp. Page: http://www.iucnredlist.org/. IUCN Species Survival Commission, Gland, Switzerland and Cambridge, UK.

IUCN. 2013. Status and trends of Caribbean coral reefs: 1969-2012. Global Coral Reef Monitoring Network, Washington, D. C.

Jaap, W. C. 1974. Scleractinian growth rate studies.

Jaap, W. C. 1984. The ecology of south Florida coral reefs: A community profile, FWS/OBS-82/08.

Jaap, W. C., W. G. Lyons, P. Dustan, and J. C. Halas. 1989. Stony coral (Scleractinia and Milleporina) community structure at Bird Key Reef, Ft. Jefferson National Monument, Dry Tortugas, Florida.

Jackson, J. B. C., K. L. Cramer, M. Donovan, A. Friedlander, and V. Lam. 2012. Tropical Americas Coral Reef Resilience Workshop.

Jackson, J. B. C., M. K. Donovan, K. L. Cramer, and V. V. Lam. 2014. Status and Trends of Caribbean Coral Reefs: 1970-2012. Global Coral Reef Monitoring Network, IUCN, Gland, Switzerland.

Jokiel, P. L., and coauthors. 2008. Ocean acidification and calcifying reef organisms: a mesocosm investigation. Coral Reefs 27(3):473-483.

Keck, J., R. S. Houston, S. Purkis, and B. M. Riegl. 2005. Unexpectedly high cover of Acropora cervicornis on offshore reefs in Roatán (Honduras). Coral Reefs 24(3):509.

Keller, B. D., J. B. C. Jackson, and (eds). 1991. Long-term assessment of the oil spill at Bahia Las Minas, Panama, interim report, volume I: executive summary. US Dept. of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, OCS Study MMS 90-0030, New Orleans, La.

Kendall, J., E. N. Powell, S. J. Connor, and T. J. Bright. 1983. The effects of drilling fluids (muds) and turbidity on the growth and metabolic state of the coral Acropora cervicornis, with comments on methods of normalization for coral data. Bulletin of Marine Science 33(2):336-352.

Knutson, S., C. A. Downs, and R. H. Richmond. 2012. Concentrations of Irgarol in selected marinas of Oahu, Hawaii and efects on settlement of coral larvae. Ecotoxicology 21:1-8.

Kramer, P. R. 2002. Status and Trends Working Group Report. Pages 28-37 *in* A. W. Bruckner, editor Proceedings of the Caribbean Acropora workshop: Potential application of the U.S. Endangered Species Act as a conservation strategy. NOAA Technical Memorandum NMFS-OPR-24, Silver Spring, MD.

Kuffner, I. B., A. J. Andersson, P. L. Jokiel, K. S. Rodgers, and F. T. Mackenzie. 2008. Decreased abundance of crustose coralline algae due to ocean acidification. Nature Geoscience 1(2):114-117

Kuntz, N. M., D. I. Kline, S. A. Sandin, and F. Rohwer. 2005. Pathologies and mortality rates caused by organic carbon and nutrient stressors in three Caribbean coral species. Marine Ecology Progress Series 294:173-180.

Landry, J. B., W. J. Kenworthy, and G. D. Carlo. 2008. The effects of docks on seagrasses, with particular emphasis on the threatened seagrass, *Halophila johnsonii*. Report submitted to NMFS Office of Protected Resources.

Langdon, C., and coauthors. 2003. Effect of elevated CO_2 on the community metabolism of an experimental coral reef. Global Biogeochemical Cycles 17(1):1-14.

Lapointe, B. E., P. J. Barile, M. M. Littler, and D. S. Littler. 2005. Macroalgal blooms on southeast Florida coral reefs II. Cross-shelf discrimination of nitrogen sources indicates widespread assimilation of sewage nitrogen. Harmful Algae 4:1106-1122.

Lapointe, B. E., P. J. Barile, and W. R. Matzie. 2004. Anthropogenic nutrient enrichment of seagrass and coral reef communities in the Lower Florida Keys: discrimination of local versus regional nitrogen sources. Journal of Experimental Marine Biology and Ecology 308(1):23-58.

Lasker, H. R. 1980. Sediment rejection by reef corals: the roles of behavior and morphology in Montastrea cavernosa (Linnaeus). Journal of Experimental Marine Biology and Ecology 47(1):77-87.

Leder, J. J., A. M. Szmant, and P. K. Swart. 1991. The effect of prolonged “bleaching” on skeletal banding and stable isotopic composition in *Montastrea annularis*. Coral Reefs 10(1):19-27.

Levitan, D. R., and coauthors. 2004. Mechanisms of reproductive isolation among sympatric broadcast-spawning corals of the *Montastraea annularis* species complex. Evolution 58(2):308-323.

Lewis, J. B. 1974. The settlement behaviour of planulae larvae of the hermatypic coral *Favia fragum* (Esper). Journal of Experimental Marine Biology and Ecology 15:165-172.

Lewis, J. B. 1977. Suspension feeding in Atlantic reef corals and the importance of suspended particulate matter as a food source. Proceedings of the 3rd International Coral Reef Symposium:405-408.

Lidz, B. H., and D. G. Zawada. 2013. Possible Return of Acropora cervicornis at Pulaski Shoal, Dry Tortugas National Park, Florida. Journal of Coastal Research 29(2):256-271.

Lindahl, U. 2003. Coral reef rehabilitation through transplantation of staghorn corals: effects of artificial stabilization and mechanical damages. Coral Reefs 22(3):217-223.

Lirman, D., and coauthors. 2010. A window to the past: documenting the status of one of the last remaining 'megapopulations' of the threatened staghorn coral Acropora cervicornis in the Dominican Republic. Aquatic Conservation: Marine and Freshwater Ecosystems 20(7):773-781.

Lopez, J. V., R. Kersanach, S. A. Rehner, and N. Knowlton. 1999. Molecular determination of species boundaries in corals: Genetic analysis of the Montastraea annularis complex using amplified fragment length polymorphisms and a microsatellite marker. Biological Bulletin 196(1):80-93.

Loya, Y., and B. Rinkevich. 1980. Effects of oil pollution on coral reef communities. Marine Ecology Progress Series 3(16):167-180.

Marszalek, D. S. 1981. Impact of dredging on a subtropical reef community, Southeast Florida, USA. Pages 147-153 *in* Proceedings of the Fourth International Coral Reef Symposium, Manila, volume 1.

Marubini, F., and P. S. Davies. 1996. Nitrate increases zooxanthellae population density and reduces skeletogenesis in corals. Marine Biology 127(2):319-328.

McClanahan, T. R., and N. A. Muthiga. 1998. An ecological shift in a remote coral atoll of Belize over 25 years. Environmental Conservation 25(2):122-130.

Mendes, J. M., and J. D. Woodley. 2002. Effect of the 1995-1996 bleaching event on polyp tissue depth, growth, reproduction and skeletal band formation in Montastraea annularis. Marine Ecology Progress Series 235:93-102.

Miller, J., and coauthors. 2009. Coral disease following massive bleaching in 2005 causes 60% decline in coral cover on reefs in the US Virgin Islands. Coral Reefs 28(4):925-937.

Miller, M. W., and D. E. Williams. 2007. Coral disease outbreak at Navassa, a remote Caribbean island. Coral Reefs 26(1):97-101.

Miller, S. L., W. F. Precht, L. M. Rutten, and M. Chiappone. 2013. Florida Keys Population Abundance Estimates for Nine Coral Species Proposed for Listing Under the U.S. Endangered Species Act., 1(1), Dania Beach, Florida.

Morse, A. N. C., and coauthors. 1996. An ancient chemosensory mechanism brings new life to coral reefs. Biological Bulletin 191:149-154.

Morse, D. E., N. Hooker, A. N. C. Morse, and R. A. Jensen. 1988. Control of larval metamorphosis and recruitment in sympatric agariciid corals. Journal of Experimental Marine Biology and Ecology 116(3):193-217.

Morse, D. E., A. N. C. Morse, P. T. Raimondi, and N. Hooker. 1994. Morphogen-based chemical flypaper for *Agaricia humilis* coral larvae. Biological Bulletin 186:172-181.

Muller, E. M., C. S. Rogers, A. S. Spitzack, and R. van Woesik. 2008. Bleaching increases likelihood of disease on Acropora palmata (Lamarck) in Hawksnest Bay, StJohn, US Virgin Islands. Coral Reefs 27(1):191-195.

Mumby, P. J., A. Hastings, and H. J. Edwards. 2007. Thresholds and the resilience of Caribbean coral reefs. Nature 450(7166):98-101.

Negri, A. P., and A. J. Heyward. 2000. Inhibition of Fertilization and Larval Metamorphosis of the Coral Acropora millepora (Ehrenberg, 1834) by Petroleum Products. Marine Pollution Bulletin 41(7-12):420-427.

Negri, A. P., and A. J. Heyward. 2001. Inhibition of coral fertilisation and larval metamorphosis by tributyltin and copper. Marine Environmental Research 51(1):17-27.

Negri, A. P., P. A. Marshall, and A. J. Heyward. 2007. Differing effects of thermal stress on coral fertilization and early embryogenesis in four Indo Pacific species. Coral Reefs 26(4):759-763.

Negri, A. P., N. S. Webster, R. T. Hill, and A. J. Heyward. 2001. Metamorphosis of broadcast spawning corals in response to bacterial isolated from crustose algae. Marine Ecology Progress Series 223:121-131.

NMFS. 2002. Recovery Plan for Johnson's Seagrass (*Halophila johnsonii*). Prepared by the Johnson's Seagrass Recovery Team for the National Marine Fisheries Service, Silver Spring, Maryland.

NMFS. 2007. Endangered Species Act 5-Year Review: Johnson's Seagrass (Halophila johnsonii, Eiseman). National Marine Fisheries Service, Silver Spring, Maryland.

Oxenford, H. A., and coauthors. 2008. Quantitative observations of a major coral bleaching event in Barbados, Southeastern Caribbean. Climatic Change 87(3-4):435-449.

Pait, A. S., and coauthors. 2007. An assessment of chemical contaminants in the marine sediments of southwest Puerto Rico, Silver Spring, MD.

Patterson, K. L., and coauthors. 2002. The etiology of white pox, a lethal disease of the Caribbean elkhorn coral, *Acropora palmata*. Proceedings of the National Academy of Sciences 99(13):8725-8730.

Philipp, E., and K. Fabricius. 2003. Photophysiological stress in scleractinian corals in response to short-term sedimentation. Journal of Experimental Marine Biology and Ecology 287(57-78).

Porter, J. W. 1976. Autotrophy, heterotrophy, and resource partitioning in Caribbean reef-building corals. The American Naturalist 110(975):731-742.

Porter, J. W. 1987. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (south Florida): reef-building corals.

Precht, W., R. Aronson, R. Moody, and L. Kaufman. 2010. Changing patterns of microhabitat utilization by the threespot damselfish, *Stegastes planifrons*, on Caribbean Reefs. PLoS ONE 5(5):171-233.

Quinn, N., and B. Kojis. 2008. The recent collapse of a rapid phase-shift reversal on a Jamaican north coast coral reef after the 2005 bleaching event. Rev. biol. trop 56(1):149-159.

Rachello-Dolmen, P. G., and D. F. R. Cleary. 2007. Relating coral species traits to environmental conditions in the Jakarta Bay/Pulau Seribu reef system, Indonesia. Estuarine, Coastal and Shelf Science 73(3-4):816-826.

Randall, C. J., and A. M. Szmant. 2009. Elevated temperature affects development, survivorship, and settlement of the elkhorn coral, *Acropora palmata* (Lamarck 1816). Biological Bulletin 217:269-282.

Rasher, D. B., and coauthors. 2012. Effects of herbivory, nutrients, and reef protection on algal proliferation and coral growth on a tropical reef. Oecologia 169(1):187-198.

Rasher, D. B., and M. E. Hay. 2010. Chemically rich seaweeds poison corals when not controlled by herbivores. Proceedings of the National Academy of Sciences of the United States of America 107(21):9683-9688.

Rasher, D. B., E. P. Stout, S. Engel, J. Kubanek, and M. E. Hay. 2011. Macroalgal terpenes function as allelopathic agents against reef corals. Proceedings of the National Academy of Sciences of the United States of America 108(43):17726-17731.

Reichelt-Brushett, A. J., and P. L. Harrison. 2000. The effect of copper on the settlement success of larvae from the scleractinian coral *Acropora tenuis*. Marine Pollution Bulletin 41(7-12):385-391.

Reichelt-Brushett, A. J., and P. L. Harrison. 2005. The effect of selected trace metals on the fertilization success of several scleractinian coral species. Coral Reefs 24(4):524-534.

Renegar, D. A., and B. M. Riegl. 2005. Effect of nutrient enrichment and elevated CO_2 partial pressure on growth rate of Atlantic scleractinian coral *Acropora cervicornis*. Marine Ecology Progress Series 293:69-76.

Richmond, R. H., and C. L. Hunter. 1990. Reproduction and recruitment of corals: comparisons among the Caribbean, the Tropical Pacific, and the Red Sea Marine Ecology Progress Series 60(1):185-203.

Riegl, B., and G. M. Branch. 1995. Effects of sediment on the energy budgets of four scleractinian (Bourne 1900) and five alcyonacean (Lamouroux 1816) corals. Journal of Experimental Marine Biology and Ecology 186(2):259-275.

Riegl, B., S. J. Purkis, J. Keck, and G. P. Rowlands. 2009. Monitored and modeled coral population dynamics and the refuge concept. Marine Pollution Bulletin 58(1):24-38.

Ritson-Williams, R., V. J. Paul, S. N. Arnold, and R. S. Steneck. 2009. Larval settlement preferences and post-settlement survival of the threatened Caribbean corals *Acropora palmata* and *A. cervicornis*. Coral Reefs.

Ritson-Williams, R., V. J. Paul, S. N. Arnold, and R. S. Steneck. 2010. Larval settlement preferences and post-settlement survival of the threatened Caribbean corals *Acropora palmata* and *A. cervicornis*. Coral Reefs 29(1):71-81.

Rodriguez-Ramirez, A., and coauthors. 2010. Recent dynamics and condition of coral reefs in the Colombian Caribbean. Revista De Biologia Tropical 58:107-131.

Rogers, C., and coauthors. 2002. Acropora in the U.S. Virgin Islands: a wake or an awakening? A status report prepared for the National Oceanographic and Atmospheric Administration. Pages 99-122 *in* A. W. Bruckner, editor. Proceedings of the Caribbean Acropora workshop: potential application of the U.S. Endangered Species Act as a conservation strategy. NOAA Technical Memorandum NMFS-OPR-24, Silver Spring, MD.

Rogers, C. S. 1979. The effect of shading on coral reef structure and function. Journal of Experimental Marine Biology and Ecology 41(3):269-288.

Rogers, C. S. 1983. Sublethal and lethal effects of sediments applied to common Caribbean reef corals in the field. Marine Pollution Bulletin 14(10):378-382.

Rogers, C. S., H. C. I. Fitz, M. Gilnack, J. Beets, and J. Hardin. 1984. Scleractinian coral recruitment patterns at Salt River submarine canyon, St. Croix, U.S. Virgin Islands. Coral Reefs 3:69-76.

Rogers, C. S., T. H. Suchanek, and F. A. Pecora. 1982. Effects of Hurricanes David and Frederic (1979) on shallow *Acropora palmata* reef communities: St. Croix, U.S. Virgin Islands. Bulletin of Marine Science 32(2):532-548.

Ross, C., R. Ritson-Williams, K. Olsen, and V. J. Paul. 2013. Short-term and latent post-settlement effects associated with elevated temperature and oxidative stress on larvae from the coral Porites astreoides. Coral Reefs 32(1):71-79.

Rotjan, R., and S. Lewis. 2006. Parrotfish abundance and selective corallivory on a Belizean coral reef. Journal of Experimental Marine Biology and Ecology 335(2):292-301.

Rotjan, R. D., and coauthors. 2006. Chronic parrotfish grazing impedes coral recovery after bleaching. Coral Reefs 25(3):361-368.

Rotjan, R. D., and S. M. Lewis. 2008. Impact of coral predators on tropical reefs. Marine Ecology Progress Series 367:73-91.

Ruppert, J. L. W., M. J. Travers, L. L. Smith, M.-J. Fortin, and M. G. Meekan. 2013. Caught in the Middle: Combined Impacts of Shark Removal and Coral Loss on the Fish Communities of

Coral Reefs. PLoS ONE 8(9):e74648.

Ruzicka, R. R., and coauthors. 2013. Temporal changes in benthic assemblages on Florida Keys reefs 11 years after the 1997/1998 El Niño. Marine Ecology Progress Series 489:125-141.

Rylaarsdam, K. W. 1983. Life histories and abundance patterns of colonial corals on Jamaican reefs. Marine Ecology Progress Series 13:249-260.

Sammarco, P. W. 1980. *Diadema* and its relationship to coral spat mortality: grazing, competition, and biological disturbance. J. Exp. Mar. Biol. Ecol. 45(2-3):245-272.

Sammarco, P. W. 1985. The Great Barrier Reef vs. the Caribbean; comparisons of grazers, coral recruitment patterns and reef recovery. Proceedings of the 5th international Coral Reef Congress 4:391-397.

Schärer, M., and coauthors. 2009. Elkhorn Coral Distribution and Condition throughout the Puerto Rican Archipelago. Proceedings of the 11th International Coral Reef Symposium, Ft. Lauderdale, Florida.

Schnitzler, C. E., L. L. Hollingsworth, D. A. Krupp, and V. M. Weis. 2012. Elevated temperature impairs onset of symbiosis and reduces survivorship in larvae of the Hawaiian coral, Fungia scutaria. Marine Biology 159(3):633-642.

Shinn, E. A. 1966. Coral growth-rate, and environmental indicator. Journal of Paleontology 40(2):233-240.

Shinn, E. A. 1976. Coral reef recovery in Florida and the Persian Gulf. Environmental Geology 1:241-254.

Smith, S. R., and R. B. Aronson. 2006. Population dynamics of *Montastraea* spp. in the Florida Keys' Fully Protected Zones: modeling future trends.

Smith, S. R., R. B. Aronson, and J. Ogden. 2008. Continuing decline of *Montastraea* populations on protected and unprotected reefs in the Florida Keys National Marine Sanctuary. 11th International Coral Reef Symposium, Ft. Lauderdale, FL.

Soong, K., and J. C. Lang. 1992. Reproductive intergration in reef corals. Biological Bulletin 183:418-431.

Stafford-Smith, M. G. 1993. Sediment-rejection efficiency of 22 species of Australian scleractinian corals. Marine Biology 115(2):229-243.

Stafford-Smith, M. G., and R. F. G. Ormond. 1992. Sediment-rejection mechanisms of 42 species of Australian scleractinian corals. Marine and Freshwater Research 43(4):683-705.

Szmant-Froelich, A. 1985. The effect of colony size on the reproductive ability of the Caribbean coral *Montastrea annularis* (Ellis and Solander). Pages 295–300 *in* C. Gabrie, and B. Salvat, editors. 5th International Coral Reef Symposium, Tahiti.

Szmant, A. M. 1986. Reproductive ecology of Caribbean reef corals. Coral Reefs 5(1):43-53.

Szmant, A. M. 2002. Nutrient enrichment on coral reefs: is it a major cause of coral reef decline? Estuaries and Coasts 25(4):743-766.

Szmant, A. M., and N. J. Gassman. 1990. The effects of prolonged “bleaching” on the tissue biomass and reproduction of the reef coral *Montastrea annularis*. Coral Reefs 8(4):217-224.

Szmant, A. M., and M. W. Miller. 2005. Settlement preferences and post-settlement mortality of laboratory cultured and settled larvae of the Caribbean hermatypic corals *Montastaea faveolata* and *Acropora palmata* in the Florida Keys, USA. Pages 43-49 *in* Proc. 10th Int Coral Reef Symposium.

Szmant, A. M., E. Weil, M. W. Miller, and D. E. Colón. 1997. Hybridization within the species complex of the scleractinan coral *Montastraea annularis*. Marine Biology 129(4):561-572.

Tarrant, A. M., M. J. Atkinson, and S. Atkinson. 2004. Effects of steroidal estrogens on coral growth and reproduction. Marine Ecology Progress Series 269:121-129.

Tomascik, T. 1990. Growth rates of two morphotypes of Montastrea annularis along a eutrophication gradient, Barbados, WI. Marine Pollution Bulletin 21(8):376-381.

Torres, J. L., and J. Morelock. 2002. Effect of terrigenous sediment influx on coral cover and linear extension rates of three Caribbean massive coral species. Caribbean Journal of Science 38(3/4):222-229.

Tunnicliffe, V. 1981. Breakage and propagation of the stony coral Acropora cervicornis. Proceedings of the National Academy of Sciences 78(4):2427-2431.

Van Duyl, F. C. 1985. Atlas of the Living Reefs of Curacao and Bonaire (Netherlands Antilles). Vrije Universiteit, Amsterdam.

Vargas-Angel, B., J. D. Thomas, and S. M. Hoke. 2003. High-latitude *Acropora cervicornis* thickets off Fort Lauderdale, Florida, USA. Coral Reefs 22(4):465-473.

Vaughan, T. W. 1915. The geological significance of the growth rate of the Floridian and Bahamian shoal-water corals. Journal of the Washington Academy of Science 5:591-600.

Vermeij, M. J. A., K. L. Marhaver, C. M. Huijbers, I. Nagelkerken, and S. D. Simpson. 2010. Coral larvae move toward reef sounds. PLoS ONE 5(5):e10660.

Veron, J. E. N. 2000. Corals of the World. Australian Institute of Marine Science. Townsville, Australia 3 volumes.

Vijayavel, K., C. A. Downs, G. K. Ostrander, and R. H. Richmond. 2012. Oxidative DNA damage induced by iron chloride in the larvae of the lace coral Pocillopora damicornis. Comparative Biochemistry and Physiology C-Toxicology & Pharmacology 155(2):275-280.

Villinski, J. T. 2003. Depth-independent reproductive characteristics for the Caribbean reef-building coral *Montastraea faveolata*. Marine Biology 142(6):1043-1053.

Vollmer, S. V., and S. R. Palumbi. 2007. Restricted gene flow in the Caribbean staghorn coral Acropora cervicornis: Implications for the recovery of endangered reefs. Journal of Heredity 98(1):40-50.

Wagner, D. E., P. Kramer, and R. van Woesik. 2010. Species composition, habitat, and water quality influence coral bleaching in southern Florida. Marine Ecology Progress Series 408:65-78.

Walker, B. K., E. A. Larson, A. L. Moulding, and D. S. Gilliam. 2012. Small-scale mapping of indeterminate arborescent acroporid coral (*Acropora cervicornis*) patches. Coral Reefs.

Ward, P., and M. J. Risk. 1977. Boring pattern of the sponge Cliona vermifera in the coral Montastrea annularis. Journal of Paleontology 51(3):520-526.

Weil, E., and N. Knowton. 1994. A multi-character analysis of the Caribbean coral Montastraea annularis (Ellis and Solander, 1786) and its two sibling species, M. faveolata (Ellis and

Solander, 1786) and M. franksi (Gregory, 1895). Bulletin of Marine Science 55(1):151-175.

Weil, E., I. Urreiztieta, and J. Garzón-Ferreira. 2002. Geographic variability in the incidence of coral and octocoral diseases in the wider Caribbean. Proceedings of the 9th International Coral Reef Symposium 2:1231-1237.

Wells, J. W. 1933. A study of the reef Madreporaria of the Dry Tortugas and sediments of coral reefs. Cornell University, Ithaca, NY.

Wilkinson, C., and D. Souter. 2008. Status of Caribbean coral reefs after bleaching and hurricanes in 2005, Townsville.

Williams, D. E., and M. W. Miller. 2005. Coral disease outbreak: pattern, prevalence and transmission in *Acropora cervicornis*. Marine Ecology Progress Series 301:119-128.

Williams, D. E., M. W. Miller, and K. L. Kramer. 2008. Recruitment failure in Florida Keys *Acropora palmata*, a threatened Caribbean coral. Coral Reefs 27:697-705.

Williams, D. E., M. W. Miller, and K. L. Kramers. 2006. Demographic monitoring protocols for threatened Caribbean Acropora spp. corals.

Woodley, J. D., and coauthors. 1981. Hurricane Allen's impact on Jamaican coral reefs. Science 214(4522):749-755.

Wooldridge, S. A. 2009. Water quality and coral bleaching thresholds: Formalising the linkage for the inshore reefs of the Great Barrier Reef, Australia. Marine Pollution Bulletin 58(5):745-751.

17 APPENDIX A

Transplantation Protocol

All relocation field activities, data collection, analysis and reporting will be supervised by a marine biologist (minimum academic requirement is M.S. degree in related field, or equivalent experience) with experience in coral transplantation and survival monitoring. The qualifications of any persons conducting transplantation work must be submitted to NMFS Protected Resources Division, for review.

The colonies will be collected carefully using a hammer and chisel. Upon collection, the colonies must be kept in bins and maintained in seawater at all times. During transportation to the transplant site, the corals must be covered. Transplantation should occur as soon as operationally feasible and no more than 24 hours after the colony is removed from its original location. The collected colonies must be kept at the original depth until transplantation commences (i.e., cached on site).

The USCG must ensure that all colonies are re-located to suitable habitat at an approved site (in this case, the coral nursery at the Miami Science Museum has been identified as the receptor site).

To assist in monitoring efforts, a plastic identification tag must be attached adjacent to each transplanted colony. Finally, the collected location, length, width, depth and orientation of each colony to be transplanted will be recorded. The transplanted location, as well as the species and identification number, will be recorded.

SEA TURTLE AND SMALLTOOTH SAWFISH CONSTRUCTION CONDITIONS

The permittee shall comply with the following protected species construction conditions:

a. The permittee shall instruct all personnel associated with the project of the potential presence of these species and the need to avoid collisions with sea turtles and smalltooth sawfish. All construction personnel are responsible for observing water-related activities for the presence of these species.

b. The permittee shall advise all construction personnel that there are civil and criminal penalties for harming, harassing, or killing sea turtles or smalltooth sawfish, which are protected under the Endangered Species Act of 1973.

c. Siltation barriers shall be made of material in which a sea turtle or smalltooth sawfish cannot become entangled, be properly secured, and be regularly monitored to avoid protected species entrapment. Barriers may not block sea turtle or smalltooth sawfish entry to or exit from designated critical habitat without prior agreement from the National Marine Fisheries Service's Protected Resources Division, St. Petersburg, Florida.

d. All vessels associated with the construction project shall operate at "no wake/idle" speeds at all times while in the construction area and while in water depths where the draft of the vessel provides less than a four-foot clearance from the bottom. All vessels will preferentially follow deep-water routes (e.g., marked channels) whenever possible.

e. If a sea turtle or smalltooth sawfish is seen within 100 yards of the active daily construction/dredging operation or vessel movement, all appropriate precautions shall be implemented to ensure its protection. These precautions shall include cessation of operation of any moving equipment closer than 50 feet of a sea turtle or smalltooth sawfish. Operation of any mechanical construction equipment shall cease immediately if a sea turtle or smalltooth sawfish is seen within a 50-ft radius of the equipment. Activities may not resume until the protected species has departed the project area of its own volition.

f. Any collision with and/or injury to a sea turtle or smalltooth sawfish shall be reported immediately to the National Marine Fisheries Service's Protected Resources Division (727-824-5312) and the local authorized sea turtle stranding/rescue organization.

g. Any special construction conditions, required of your specific project, outside these general conditions, if applicable, will be addressed in the primary consultation.

Revised: March 23, 2006

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
P.O. BOX 4970
JACKSONVILLE, FLORIDA 32232-0019

REPLY TO
ATTENTION OF

Planning and Policy Division
Environmental Branch

APR 16 2014

Mr. Larry Williams
US Fish and Wildlife Service
South Florida Ecological Services Field Office
1339 20th Street
Vero Beach, FL 32960-3559,

Pursuant to Section 7(a) of the Endangered Species Act, please find enclosed the Biological Assessment for the maintenance dredging and bulkhead replacement at U.S. Coast Guard Base Miami Beach, addressing the concerns of the threatened and endangered species under the purview of the U.S. Fish and Wildlife Service (FWS). Listed species which may occur in the vicinity of the proposed work and are under the jurisdiction of the FWS are: West Indian manatee (*Trichechus manatus latirostris*) and American crocodile (*Crocodylus acutus*). Based on the enclosed Biological Assessment, the USCG has determined that the proposed action may affect, but is not likely to adversely affect the species identified in the Biological Assessment and it will not adversely modify designated critical habitat in the project area. The USCG requests your written concurrence on this determination.

The Corps is serving as the USCG's agent for this action, and will also adopt the results of the consultation for issuance of the Section 10/Section 404 permits from Corps to USCG for the required work. If you have any questions or need further information, please contact Mrs. Terri Jordan-Sellers at 904-232-1701 or by email: Terri.Jordan-Sellers@usace.army.mil.

Sincerely,

Kenneth R Duggs
for Eric P. Summa
Chief, Environmental Branch

Enclosure

This page intentionally left blank

CONSULTATION UNDER SECTION 7 OF THE ENDANGERED SPECIES ACT WITH U.S. FISH AND WILDLIFE SERVICE - MAINTENANCE DREDGING OF COAST GUARD CUTTER HUDSON'S SLIP AND REPLACEMENT OF BULKHEADS AT COAST GUARD BASE MIAMI BEACH

The Coast Guard is completing a draft Environmental Assessment (EA) for the maintenance dredging of the Coast Guard Cutter (CGC) Hudson's slip and replacement of bulkheads at Coast Guard Base (CGB) Miami Beach.

Project Location

The US Coast Guard Station, Miami Beach is located in Miami-Dade County on a man-made island, on the south side of Melloy Channel (Figure 1 and Figure 2) and north of the main entrance to the Port of Miami, Government Cut. Miami-Dade County is located on the southeast coast of Florida between Fort Lauderdale and the Florida Keys. The County is bounded to the north by Broward County and to the south by Monroe County.

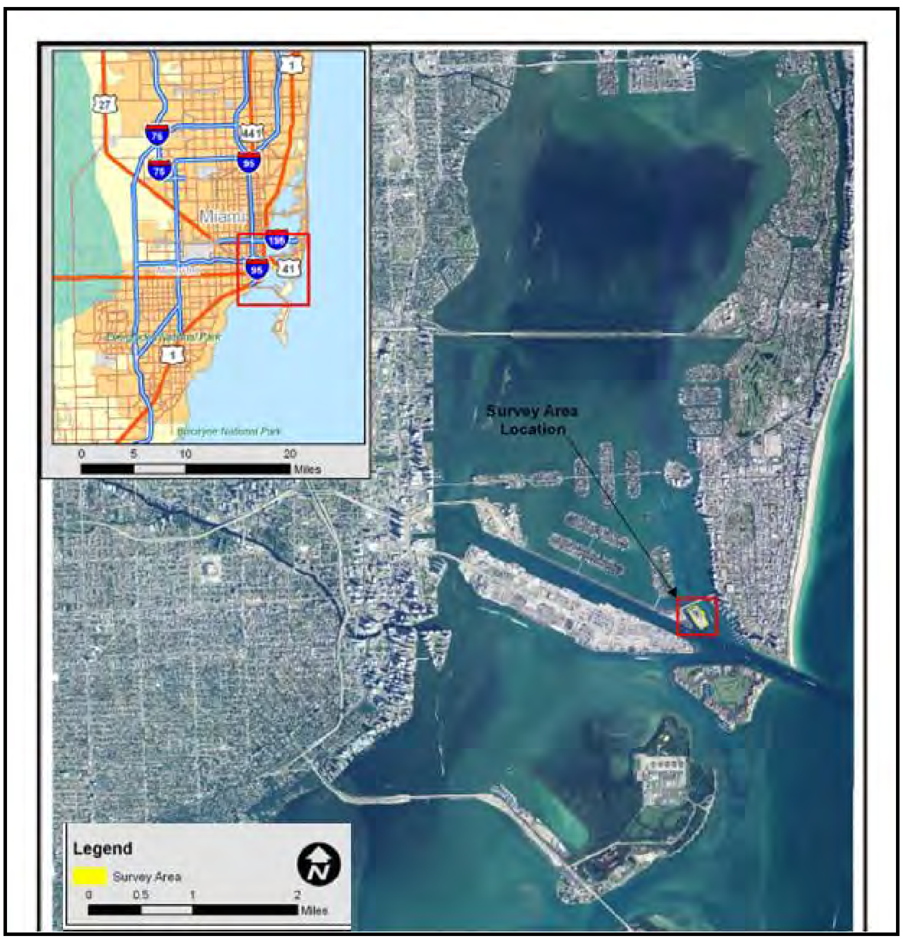


Figure 1 - Location of USCG Base Miami Beach

Figure 2 - USCG Base Miami Beach looking east

Description of the Proposed Action

The Coast Guard proposes to maintenance dredge up to 5,000 cubic yards of material from the CGC Hudson's slip and replace bulkheads on the eastern and southern sides of the Coast Guard Base Miami Beach. The CGC Hudson is berthed on the east side of CGB Miami Beach. The berth is 300 feet long by 85 feet wide (Figure 3). The site was last maintained in early 1995. Dredging will be done with either a mechanical dredge (clamshell or backhoe) or a small cutterhead dredge with dredged material disposal with a bottom dump scow in the Miami Ocean Dredged Material Disposal Site.

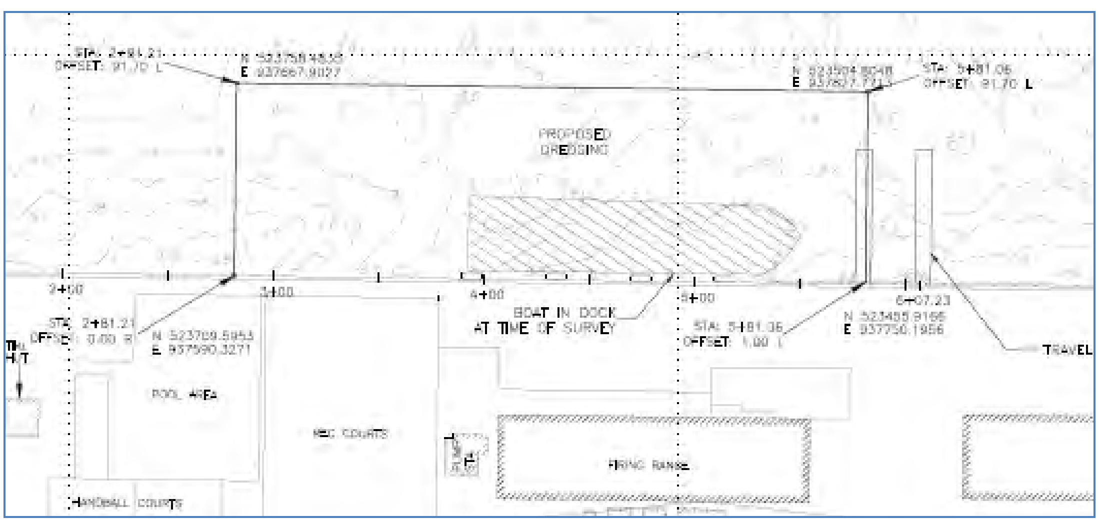


Figure 3 - Schematic of the CGC Hudson's slip

The current bulkhead is steel sheet pile with a concrete cap, which retains the soil backfill around the entire island. The island was constructed in the 1940's and the east and north bulkheads are original. Additional areas were built out in the 1960's and some sections were replaced in the 1980's.

The Coast Guard uses areas along the bulkhead to moor and support Coast Guard Cutters. Sections of bulkhead have reached the end of their service life such that vehicle loading is restricted on the shore side which impacts the operations of the Cutters. Approximately 1,261 linear feet of bulkhead along the east and south section of the island is scheduled for replacement (Figure 4). The scope of this work will be the replacement of two "zones", or lengths of bulkhead separated by era and type of construction. This work will be completed through a commercial contract administered by Coast Guard Civil Engineering Unit Miami.

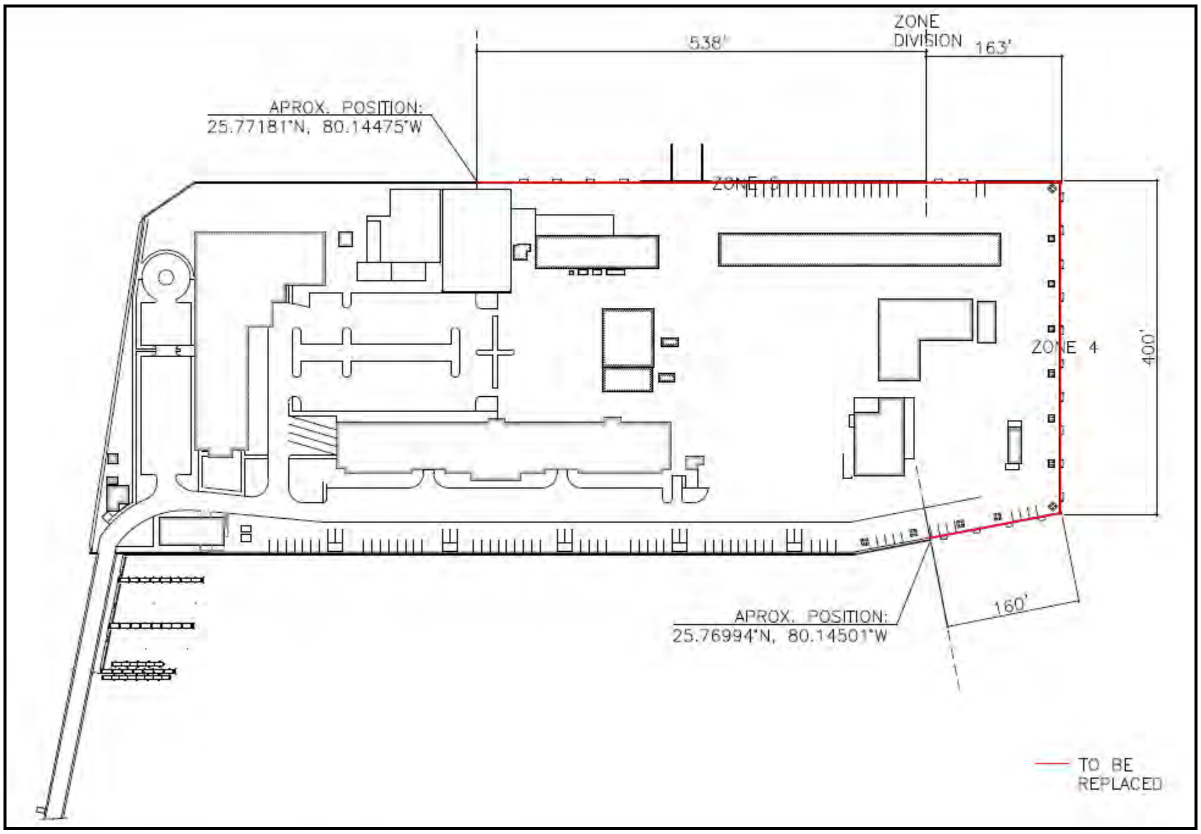


Figure 4 - Schematic of eastern and southern bulkheads needing replacement

Protected Species Under USFWS Jurisdiction Included in this Assessment

The following endangered (E) species under the jurisdiction of the U.S. Fish and Wildlife Service (USFWS) may occur in or near the action area:

Common Name	**Scientific Name**	**Status**
Marine Mammals		
West Indian (Florida) manatee	*Trichechus manatus latirostris*	E
American crocodile	*Crocodylus acutu*s	E

Critical Habitat

ESA-designated critical habitat for the Florida manatee occurs within the action area. Designated critical habitat for the American crocodile does not occur within the action area (30 miles south).

Affect Determination

The Coast Guard has reviewed the biological, status, threats and distribution information presented in this assessment and believes that the following species will be in or near the action area and thus may be affected by the proposed project: West Indian (Florida) manatee and the American crocodile. Additionally, the project takes place in designated critical habitat for the manatee.

West Indian (Florida) Manatee

The Florida manatee (*Trichechus manatus latirostris)* is a subspecies of the West Indian manatee (*Trichechus manatus*) has been listed as a protected mammal in Florida since 1893. Federal law, specifically the Marine Mammal Protection Act of 1972 (MMPA) and the Endangered Species Act of 1973 (ESA) protects manatees. Florida provided further protection in 1978 by passing the Florida Marine Sanctuary Act designating the state as a manatee sanctuary and providing signage and speed zones in Florida's waterways.

Within Miami-Dade County there exist both permanent and transient populations of manatees. Surveys show that during the winter months when temperatures drop, manatees from north Florida and also Miami-Dade County will migrate to the Florida Power and Light (FP&L) power plant at Port Everglades (USGS 2000). During the spring months when the water warms, manatees return to the counties to the north and south to forage and reproduce. Telemetry and aerial surveys confirm manatees are present within Miami-Dade County all year (Miami-Dade County 1999a, USGS 2000). The surveys also confirm that they frequent the waters in and adjacent to the study area in the Port, especially in the Bill Sadowski Critical Wildlife Area, and near the Miami River and Intracoastal Waterway (IWW).

Critical Habitat

All of the waters in Miami-Dade County are designated as critical habitat for the manatee under the ESA in 1976 (50 CFR 17.95(a)). Additionally, the Florida Fish and Wildlife Conservation Commission (FWC) has designated a slow speed zone north of the Coast Guard Base. According to the 2011 manatee key, the project is not within an "Important Manatee Area" subject to further consultation or additional observer and nighttime restrictions.

American Crocodile

The American crocodile is a state and Federally listed threatened species. It is distributed along coastal and estuarine shores of the extreme southern Florida peninsula. Crocodiles primarily nest from Florida Bay to Turkey Point and on northern Key Largo. In Biscayne Bay they have been observed nesting as far north as Crandon Park, Bill Baggs State Recreation Area and Snapper Creek (USFWS 1999; Mazzotti 2000). Nesting for the crocodile begins in March and extends until late April or early May until the eggs are laid. They build their nests in well-drained soil at sites adjacent to deep-water. Adult crocodiles feed at night on schooling fish in creeks, open water, and deep channels (FP&L 1987). Crocodiles are shy animals and prefer quiet, inland ponds and creeks and protected coves. They also prefer natural, undisturbed areas for nesting, resting and feeding (USFWS 1999). Documentation of American crocodiles north of Miami-Dade County has increased over the last few years with animals being reported in Broward and Palm Beach Counties. While there are no published records specifically citing American crocodiles utilizing the waters of the project area, it is possible that they utilize the waters of the Bill Sadowski Critical Wildlife Area north of Virginia Key for foraging. Crocodiles have been recorded in the vicinity of Virginia Key and nesting on Key Biscayne (Crandon Park Marina and Bill Baggs State Recreation Area).

Critical Habitat

Critical habitat for the American crocodile includes all land and water within an area encompassed by a line beginning at the easternmost tip of Turkey Point, Miami-Dade County, on the coast of Biscayne Bay; southeast along a straight line to Christmas Point at the southernmost tip of Elliott Key; southwest along a line following the shores of the Atlantic Ocean side of Old Rhodes Key, Palo Alto Key, Angelfish Key, Key Largo, Plantation Key, Lower Matecumbe Key, and Long Key, to the westernmost tip of Long Key; northwest along a straight line to the westernmost tip of Middle Cape; north along the shore of the Gulf of Mexico to the north side of the mouth of Little Sable Creek; east along a straight line to the northernmost point of Nine-Mile Pond; northeast along a straight line to the point of beginning (50 CFR 17.95). The action area is approximately 30 miles north of American crocodile critical habitat.

Protective Measures to be taken in the Project Area as Part of the Proposed Action

The Coast Guard will incorporate the USFWS "STANDARD MANATEE CONDITIONS FOR IN-WATER WORK" into the project plans and specifications, adding the crocodile to the protection protocol. These include:

(a) All personnel associated with the project shall be instructed about the presence of manatees and manatee speed zones and crocodiles, and the need to avoid collisions with manatees and crocodiles. Construction personnel shall be advised that there are civil and criminal penalties for harming, harassing, or killing manatees and crocodiles, which are protected under the Marine Mammal Protection Act, the Endangered Species Act, and the Florida Manatee Sanctuary Act.

(b) All vessels associated with the construction project shall operate at "Idle Speed/No Wake" at all times while in the immediate area and while in water where the draft of the vessel provides less than a four-foot clearance from the bottom. All vessels will follow routes of deep water whenever possible.

(c) Siltation or turbidity barriers shall be made of material in which manatees and crocodiles cannot become entangled, shall be properly secured, and shall be regularly monitored to avoid manatee and crocodile entanglement or entrapment. Barriers must not impede manatee or crocodile movement.

(d) All on-site project personnel are responsible for observing water-related activities for the presence of manatees and crocodiles. All in-water operations, including vessels, must be shutdown if a manatee(s) or crocodile(s) comes within 50 feet of the operation. Activities will not resume until the manatee(s) or crocodile(s) has moved beyond the 50-foot radius of the project operation, or until 30 minutes elapses if the manatee(s) or crocodile(s) has not reappeared within 50 feet of the operation. Animals must not be herded away or harassed into leaving.

(e) Any collision with or injury to a manatee or crocodile shall be reported immediately to the FWC Hotline at 1-888-404-FWCC. Collision and/or injury should also be reported to the U.S. Fish and Wildlife Service in Vero Beach (1-772-562-3909).

(f) Temporary signs concerning manatees and crocodiles shall be posted prior to and during all in-water project activities. All signs are to be removed by the permittee upon completion of the project. Awareness signs that have already been approved for this use by the Florida Fish and Wildlife Conservation Commission (FWC) must be used (see MyFWC.com). One sign which reads *Caution: Manatee Habitat* must be posted. A second sign measuring at least 8

½" by 11" explaining the requirements for "Idle Speed/No Wake" and the shutdown of in-water operations must be posted in a location prominently visible to all personnel engaged in water-related activities.

EFFECTS OF THE PROJECT ON LISTED SPECIES

The effects of the action will be broken into two sections, the maintenance dredging of the slip by either mechanical or hydraulic means and the replacement of the bulkhead with direct hammer pile driving or with vibratory pile driving.

Florida Manatee

Effects of Dredging

As stated above, as part of the standard plans and specifications for the project, USCG agrees to implement the USFWS "STANDARD MANATEE CONDITIONS FOR IN-WATER WORK" in order to minimize impacts to the species from the dredging. A seagrass survey was conducted from May 28-30, 2013 including the entire perimeter of the Station within 4.6 meters (m) (15 feet) of the station and a sufficient buffer to account for side slope, with transects spaced 15.2m (50 feet) apart, perpendicular to the bulkhead. The berth of the USCG *Cutter Hudson*, located on the eastern side of the station was surveyed for seagrasses out to 30m (98 feet). Of the 0.42 acres of sea grasses mapped within the survey area, 0.13 acres (6,500 square feet) falls within the direct dredging footprint and sideslope equilibration area associated with the dredging and would be removed by the dredging (Figure 5). Seagrass beds are essential foraging habitat for manatees. Although seagrass habitats will be removed, the loss of seagrass habitats is relatively small with respect to overall seagrass abundance throughout the area. However, seagrass impacts would be mitigated by the restoration of similar habitat approximately three miles north of the impact area at the Julia Tuttle Mitigation Area. The Uniform Mitigation Assessment Method (UMAM) would be used to determine the acreage needed to adequately compensate for the loss of essential manatee habitat. Based on this information and the proposed construction techniques, USCG determined that the maintenance dredging of the Hudson's slip using a cutterhead or mechanical dredge may affect, but is not likely to adversely affect the endangered Florida manatee.

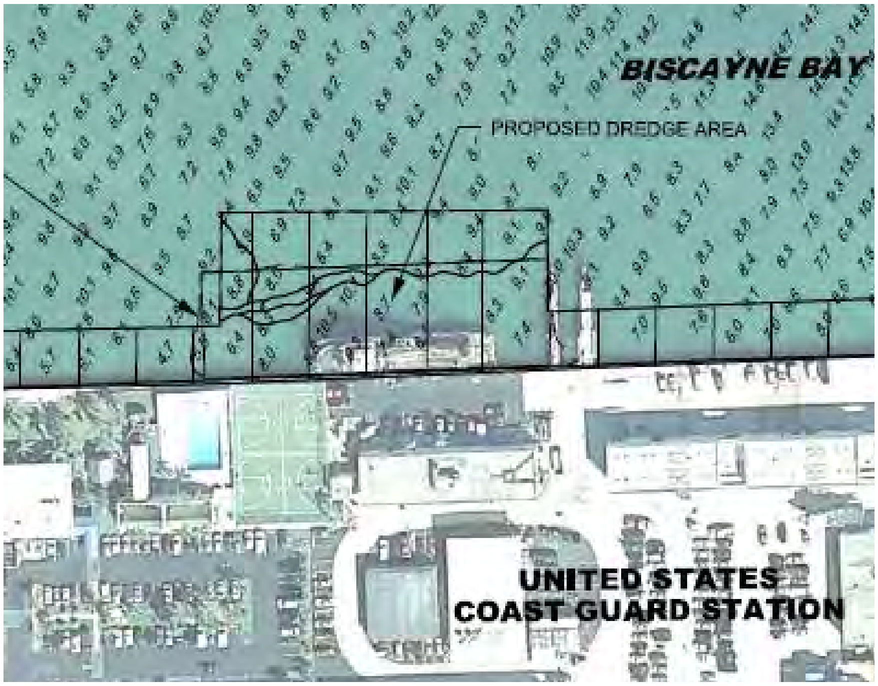


Figure 5 – Seagrass Impact Graphic

Effects of Bulkhead Construction

Utilization of pile driving to replace the sheet pile bulkhead may have an effect on manatees in the area. Both the pressure and noise associated with pile driving can impact marine mammals.

The two tables below were re-created from USN 2013. They detail representative pile driving sound pressure levels measured from 24" steel pipe piles, 24" wide steel sheet piles and 12" timber piles. Sources are indicated by footnotes in the relevant tables.

Underwater Sound Pressure Levels During Vibratory Installation Based on In-situ Monitored Construction Activities

Project and Location	Pile Size and Type	Water Depth	Range to Pile	RMS	Peak	Sediment
Portage Bay, WA[b]	24 inch steel pipe	3-7m	10m	157	170	Unknown
Berth 23 Port of Oakland, CA[c]	24 inch steel sheet pile	6.1m	10m	163	177	Unknown
Berth 30 Port of Oakland, CA[c]	24 inch steel sheet pile	4.9m	10m	162	175	Unknown
Berth 35/37 Port of Oakland, CA[c]	24 inch steel sheet pile	6.1m	10m	163	177	Unknown
Port Townsend Ferry, WA[d]	12 inch timber pile	10m	10m	153	167	Unknown
Sound levels expressed as dB re 1 μPa rms and dB re 1 μPa peak for RMS and Peak SPL measurements, respectively.						

Sources: a – Illingworth & Rodkin 2012; b- Washington Department of Transportation 2010; c- California Department of Transportation 2009 ; d – Washington Department of Transportation 2011

Underwater Sound Pressure Levels During Impact Installation Based on In-situ Monitored Construction Activities

Project and Location	Pile Size and Type	Water Depth	RMS	Peak	SEL	Sediment
Friday Harbor Ferry Terminal, WA[a]	24-inch steel sheet pile	12.8m	170	183	180	Sandy silt / clay
		13.4m	186	205	179	
		14.3m	186	204	179	
		10m	194	210	185	Sandy silt / rock
		10m	195	215	187	
		10m	193	212	184	
Typical values, CALTRANS compendium summary table[b]	24-inch steel sheet pile	15m	194	207	178	Unknown
Berth 23 Port of Oakland[b]	24-inch steel sheet pile	12 to 14m	189	205	179	unknown
Sound levels expressed as dB re 1 µPa rms and dB re 1 µPa peak for RMS and Peak SPL measurements, respectively.						

Sources: [a]WSDOT 2005; [b]CALTRANS 2009

The USFWS has not set levels defining harassment of manatees under the MMPA. However, under the MMPA NMFS has defined levels of harassment for marine mammals. Level A harassment is defined as "any act of pursuit, torment, or annoyance which has the potential to injure a marine mammal or marine mammal stock in the wild." Level B harassment is defined as "Any act of pursuit, torment, or annoyance which has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including but not limited to migration, breathing, nursing, breeding, feeding or sheltering." Current NMFS practice regarding exposure of marine mammals to pile driving noise is that cetaceans exposed to impulsive sounds at or above 180 re 1 µPa rms are considered to have been taken by Level A (i.e., injurious) harassment.

Behavioral harassment (Level B) is considered to have occurred when marine mammals are exposed to impulsive noise from impact pile driving at or above 160 dB re 1 µPa rms and for non-impulsive noise from vibratory pile driving at or above 120 dB re 1 µPa rms but below injurious thresholds.

Sound levels from vibratory pile driving are not expected to reach the 180 dB re 1 µPa sound pressure level root mean square threshold; therefore no injuries to manatees from sound associated with vibratory pile driving are anticipated. However, should manatees be near the project vicinity during pile driving operations, direct impacts could include alteration of behavior and autecology. For example, daily movements and/or seasonal migrations of manatees may be impeded or altered.

As a precautionary measure against possible behavioral effects, the USCG will utilize a shutdown zone which will always be a minimum of 15 m (50 ft). For impact pile driving which generates impulsive sound, a larger 40 m (130 ft) shutdown zone shall be implemented for marine mammals only; the standard shutdown zone will continue to be applied for all other protected species. If a protected species approaches or enters a shutdown zone during any in-water work, activity will be halted and delayed until either the animal has voluntarily left and been visually confirmed beyond the shutdown zone or 15 minutes have passed without re-detection of the animal. Based on this information and the proposed construction techniques, USCG determined that the bulkhead construction using vibratory or impact pile driving may affect, but is not likely to adversely affect the endangered Florida manatee.

American Crocodile

Effects from Dredging

Crocodiles are shy, unaggressive animals, and as such, the USCG believes that it is very unlikely that a crocodile will be seen in or near the project area during construction due to the high amount of vessel traffic in this busy port. However, due to the proximity of areas of recorded sightings of crocodiles, we are including the American crocodile in the assessment of effects. The logic set forth about mechanical dredges in the 1991, 1995 and 1997 SARBO by NMFS for sea turtles holds true for American crocodile and dredging of the CGC Hudson's berth. The impacts of dredging operations on sea turtles have been previously assessed by NMFS (NMFS, 1991; NMFS 1995; NMFS 1997; NMFS 2003) in the various versions of the SARBO and the 2003 (revised in 2005 and 2007) Gulf Regional Biological Opinion.

The 1991 SARBO states that "clamshell dredges are the least likely to adversely affect sea turtles because they are stationary and impact very small areas at a given time. Any sea turtle injured or killed by a clamshell dredge would have to be directly beneath the bucket. The chances of such an occurrence are extremely low…" (NMFS, 1991). NMFS also determined that "Of the three major dredge types, only the hopper dredge has been implicated in the mortality of endangered and threatened sea turtles." This determination was repeated in the 1995 and 1997 SARBOs (NMFS, 1995 and 1997).

The Coast Guard believes that if this statement holds true for a species that is relatively abundant in south Florida like sea turtles, it should also hold true for a very rare species like crocodile. The probability of a crocodile being taken during the maintenance dredging of the CGC Hudson's berth is so unlikely as to be discountable. As stated above, as part of the standard plans and specifications for the project, USCG agrees to implement the USFWS "STANDARD MANATEE CONDITIONS FOR IN-WATER WORK", adding the crocodile to the protection protocol in order to minimize impacts to the species from the dredging. Based on this information and the proposed construction techniques, USCG determined that the maintenance dredging of the Hudson's slip using a cutterhead or mechanical dredge may affect, but is not likely to adversely affect the endangered American crocodile.

Effects of Bulkhead Construction
Crocodiles possess integumentary sensory organs (ISO). At this time, there is little information documented about the purpose of these organs, however, some research has hinted that the purpose of these ISOs includes detecting pressure changes, sensory role in detecting underwater prey and possibly in detecting changes in salinity.

No acoustic impact criteria or thresholds have been established for American crocodile exposures to various sounds. Therefore, for the purposes of this evaluation, we use the NMFS threshold value for onset of injury to sea turtles due to both impact pile driving and vibratory pile driving which is 190 dB re 1 μPa sound pressure level root mean square. This criteria was developed in cooperation with the NMFS and is not based on experimental evidence of injuries caused to sea turtles by pile driving sound but was adopted from pinniped thresholds as a precautionary measure when addressing impacts from pile driving to sea turtles (USN 2013).

Sound levels from pile driving are not expected to reach the 190 dB re 1 μPa sound pressure level root mean square threshold; therefore no injuries to crocodiles from sound associated with pile driving are anticipated.

The USCG plans to protect crocodiles in the same manner as manatees and other listed and protected species in the action area. That would be through the use of the shutdown zone which will always be a minimum of 15 m (50 ft) to prevent injury from physical interaction of protected species with construction equipment. Based on this information and the proposed construction techniques, USCG determined that the bulkhead construction using vibratory or impact pile driving may affect, but is not likely to adversely affect the endangered American crocodile.

Summary Effects Determination
The USCG has determined that the proposed maintenance dredging of the CGC Hudson's slip may affect, but is not likely to adversely affect Florida manatees and American crocodiles in the action area. Additionally, the USCG has determined that replacing the bulkheads at CGB Miami Beach may affect, but is not likely to adversely affect Florida manatees and American crocodiles in the project area. The USCG requests concurrence with these determinations.

SUMMARY OF EFFECT DETERMINATIONS

Project effect determination summary for Florida manatee and American crocodile. May Affect, Not Likely to Adversely Affect (MANLAA).

	Mechanical Dredge	Hydraulic Dredge	Hammer Driven sheet Pile	Vibratory Driven Sheet Pile
West Indian (Florida) manatee	MANLAA	MANLAA	MANLAA	MANLAA
American crocodile	MANLAA	MANLAA	MANLAA	MANLAA

Literature Cited

CALTRANS (California Department of Transportation). (2009). Technical Guidance for Assessment and Mitigation of the Hydroacoustic Effects of Pile Driving on Fish, Appendix 1: Compendium of Pile Driving Sound Data. Prepared by: ICF Jones & Stokes and Illingworth & Rodkin, Inc. February 2009.

Florida Power & Light Company. 1987. Florida Alligators and Crocodiles. 41 pp.

Illingworth & Rodkin, Inc. (2012). *Naval Base Kitsap at Bangor Test Pile Program Acoustic Monitoring Report, Bangor, Washington.* Prepared for the U.S. Navy. 17 April 2012.

Mazzotti, F. J. (Personal Communication). University of Florida Everglades Research and Education Center. 2000.

Miami-Dade County. 1999a. Aerial Manatee Sightings 1990-1999. Department of Environmental Resources Management. Miami, Florida.

NMFS, 1991. Biological Opinion – Dredge of channels in the southeastern United States from North Carolina through Cape Canaveral, Florida. Signed November 25, 1991.

NMFS, 1995. Endangered Species Act Section 7 Consultation with the U.S. Army Corps of Engineers, South Atlantic Division on Hopper Dredging of Channels and Borrow Areas in the Southeastern U.S. from North Carolina through Florida East Coast. Signed August 25, 1995.

NMFS, 1997. Endangered Species Act Section 7 Consultation with the U.S. Army Corps of Engineers, South Atlantic Division on the Continued Hopper dredging channels and borrow areas in the southeastern United States. Signed September 25, 1997.

NMFS, 2003. Endangered Species Act Section 7 Consultation with the U.S. Army Corps of Engineers for Dredging of Gulf of mexico Navigation channels and San Mining "borrow" areas using hopper dredges by COE Galveston, New Orleans, Mobile and Jacksonville Districts. Consultation Number F/SER/2000/01287. Signed November 19, 2003 and revised June 24, 2005.

Reynolds, J.E. 2000. Distribution and abundance of the West Indian manatee (*Trichechus manatus*) around selected Florida power plants following winter cold fronts. 1999-2000. Final Report prepared for FP&L Company, Contract Number B93135-00139:47 pp.

USFWS and NMFS, 1998. Endangered Species Consultation Handbook. Procedures for Conducting Consultation and Conference Activities Under Section 7 of the Endangered Species Act. U.S. Fish &Wildlife Service and National Marine Fisheries Service. March 1998.

U.S. Fish and Wildlife Service (USFWS). 1999. South Florida Multi-species Recovery Plan.

USN, 2013. Draft Environmental Assessment: Wharf C-2 Recapitalization at Naval Station Mayport, FL. U.S. Navy. August 2013.

WSDOT (Washington State Department of Transportation). (2005). Underwater sound Levels associated with restoration of the Friday Harbor Ferry Terminal. Prepared by: Jim Laughlin, WSDOT. May 2005.

WSDOT (Washington State Department of Transportation). (2010a). Keystone Ferry Terminal –vibratory pile monitoring technical memorandum. May 2010.

WSDOT (Washington State Department of Transportation). (2010b). Underwater Sound Levels Associated with Driving Steel Piles for the State Route 520 Bridge Replacement and HOV Project Pile Installation Test Program. March 2010.

SC

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
P.O. BOX 4970
JACKSONVILLE, FLORIDA 32232-0019

REPLY TO
ATTENTION OF

Planning and Policy Division
Environmental Branch

RECEIVED
APR 21 2014
South Florida ES Office
Vero Beach, FL

APR 16 2014

Mr. Larry Williams
US Fish and Wildlife Service
South Florida Ecological Services Field Office
1339 20th Street
Vero Beach, FL 32960-3559,

2014-CPA-0164

Pursuant to Section 7(a) of the Endangered Species Act, please find enclosed the Biological Assessment for the maintenance dredging and bulkhead replacement at U.S. Coast Guard Base Miami Beach, addressing the concerns of the threatened and endangered species under the purview of the U.S. Fish and Wildlife Service (FWS). Listed species which may occur in the vicinity of the proposed work and are under the jurisdiction of the FWS are: West Indian manatee (*Trichechus manatus latirostris*) and American crocodile (*Crocodylus acutus*). Based on the enclosed Biological Assessment, the USCG has determined that the proposed action may affect, but is not likely to adversely affect the species identified in the Biological Assessment and it will not adversely modify designated critical habitat in the project area. The USCG requests your written concurrence on this determination.

The Corps is serving as the USCG's agent for this action, and will also adopt the results of the consultation for issuance of the Section 10/Section 404 permits from Corps to USCG for the required work. If you have any questions or need further information, please contact Mrs. Terri Jordan-Sellers at 904-232-1701 or by email: Terri.Jordan-Sellers@usace.army.mil.

Sincerely,

Kenneth R Dugger
Eric P. Summa
Chief, Environmental Branch

U.S. Fish and Wildlife Service
1339 20th Street
Vero Beach, Florida 32960
772-562-3909 Fax 772-562-4288

FWS Log No. 2014-CPA-0164

The proposed action is not likely to adversely affect resources protected by the Endangered Species Act of 1973 (Act), as amended (16 U.S.C. 1531 et. seq.).

This fulfills the requirements of section 7 of the Act and further action is not required. If modifications are made to the project, if additional information involving potential effects to listed species becomes available, or if a new species is listed, reinitiation of consultation may be necessary.

Victoria A. Foster
for Larry Williams, Field Supervisor

5/5/14
Date

USFWS SFESO Concurrence Justification Form

Worksheet must be completed with Supervisor Approval Prior to sending concurrence.

Project Name: CPA 0164 USCG Maintenance Dredge and Bulkhead Repair	**FWS Fed Activity #:** 2014-CPA-0164
Project Location: US Coast Guard Station, Miami Beach,Miami-Dade County	**Lead Agency #:**
File Location: L:\Project Planning\Activities\2014\Miami-Dade\CPA 0164 USCG Maintenance Dredge and Bulkhead Repair	**Biologist:** Christopherson

Was GIS Check performed: ✓ Yes Date: 04/28/2014 ☐ No **If No, Why?** (please give a brief explanation of why GIS was not needed below).

Project Description: maintenance dredge up to 5,000 cubic yards of material from the CGC Hudson's slip and replace ~1,261 linear feet of bulkheads on the eastern and southern sides of the Coast Guard Base Miami Beach. Dredging will be done with either a mechanical dredge or a small cutterhead dredge. Dredged material disposal in the Miami Ocean Dredged Material Disposal Site.

Species Present in Project Area and Determination made by Action Agency

Species	Determination	Species	Determination
American Crocodile	MANLAA		
Manatee	MANLAA		

Justification for Concurrence (sticker recommended)

The Coast Guard will incorporate the USFWS "STANDARD MANATEE CONDITIONS FOR IN-WATER WORK" into the project plans and specifications, adding the crocodile to the protection protocol. These include:

(a) All personnel associated with the project shall be instructed about the presence of manatees and manatee speed zones and crocodiles, and the need to avoid collisions with manatees and crocodiles. Construction personnel shall be advised that there are civil and criminal penalties for harming, harassing, or killing manatees and crocodiles, which are protected under the Marine Mammal Protection Act, the Endangered Species Act, and the Florida Manatee Sanctuary Act.

(b) All vessels associated with the construction project shall operate at 'Idle speed/No Wake" at all times while in the immediate area and while in water where the draft of the vessel provides less than a four-foot clearance from the bottom. All vessels will follow routes of deep water whenever possible.

(c) Siltation or turbidity barriers shall be made of material in which manatees and crocodiles cannot become entangled, shall be properly secured, and shall be regularly monitored to avoid manatee and crocodile entanglement or entrapment. Barriers must not impede manatee or crocodile movement.

(d) All on-site project personnel are responsible for observing water-related activities for the presence of manatees and crocodiles. All in-water operations, including vessels, must be shutdown if a manatee(s) or crocodile(s) comes within 50 feet of the operation. Activities will not resume until the manatee(s) or crocodile(s) has moved beyond the 50-foot radius of the project operation, or until 30 minutes elapses if the manatee(s) or crocodile(s) has not reappeared within 50 feet of the operation. Animals must not be herded away or harassed into leaving.

(e) Any collision with or injury to a manatee or crocodile shall be reported immediately to the FWC Hotline at 1-888-404-FWCC. Collision and/or injury should also be reported to the U.S. Fish and Wildlife Service in Vero Beach (1-772-562-3909).

(f) Temporary signs concerning manatees and crocodiles shall be posted prior to and during all in-water project activities. All signs are to be removed by the permittee upon completion of the project. Awareness signs that have already been approved for this use by the Florida Fish and Wildlife Conservation Commission (FWC) must be used (see MyFWC.com). One sign which reads Caution: Manatee Habitat must be posted. A second sign measuring at least 8 1/2" by 11" explaining the requirements for "Idle Speed/No Wake" and the shutdown of in-water operations must be posted in a location prominently visible to all personnel engaged in water-related activities.

Supervisor Questions/Notes

S. Christopherson	4/28/2014	Victoria G. Foster	5/5/14
Biologist Signature	**Date**	**Supervisor Signature**	**Date**

STANDARD MANATEE CONDITIONS FOR IN-WATER WORK

2011

The permittee shall comply with the following conditions intended to protect manatees from direct project effects:

a. All personnel associated with the project shall be instructed about the presence of manatees and manatee speed zones, and the need to avoid collisions with and injury to manatees. The permittee shall advise all construction personnel that there are civil and criminal penalties for harming, harassing, or killing manatees which are protected under the Marine Mammal Protection Act, the Endangered Species Act, and the Florida Manatee Sanctuary Act.

b. All vessels associated with the construction project shall operate at "Idle Speed/No Wake" at all times while in the immediate area and while in water where the draft of the vessel provides less than a four-foot clearance from the bottom. All vessels will follow routes of deep water whenever possible.

c. Siltation or turbidity barriers shall be made of material in which manatees cannot become entangled, shall be properly secured, and shall be regularly monitored to avoid manatee entanglement or entrapment. Barriers must not impede manatee movement.

d. All on-site project personnel are responsible for observing water-related activities for the presence of manatee(s). All in-water operations, including vessels, must be shutdown if a manatee(s) comes within 50 feet of the operation. Activities will not resume until the manatee(s) has moved beyond the 50-foot radius of the project operation, or until 30 minutes elapses if the manatee(s) has not reappeared within 50 feet of the operation. Animals must not be herded away or harassed into leaving.

e. Any collision with or injury to a manatee shall be reported immediately to the Florida Fish and Wildlife Conservation Commission (FWC) Hotline at 1-888-404-3922. Collision and/or injury should also be reported to the U.S. Fish and Wildlife Service in Jacksonville (1-904-731-3336) for north Florida or Vero Beach (1-772-562-3909) for south Florida, and to FWC at ImperiledSpecies@myFWC.com

f. Temporary signs concerning manatees shall be posted prior to and during all in-water project activities. All signs are to be removed by the permittee upon completion of the project. Temporary signs that have already been approved for this use by the FWC must be used. One sign which reads *Caution: Boaters* must be posted. A second sign measuring at least 8 ½" by 11" explaining the requirements for "Idle Speed/No Wake" and the shut down of in-water operations must be posted in a location prominently visible to all personnel engaged in water-related activities. These signs can be viewed at MyFWC.com/manatee. Questions concerning these signs can be sent to the email address listed above.

This page intentionally left blank

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
P.O. BOX 4970
JACKSONVILLE, FLORIDA 32232-0019

REPLY TO
ATTENTION OF

Planning and Policy Division
Environmental Branch

JUN 17 2014

Virginia Fay
Asst. Regional Administrator
NMFS-SERO-HCD
263 13th Ave South
St. Petersburg, FL 33701

Dear Ms. Fay,

Pursuant to the EFH provisions of the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) this document constitutes the Essential Fish Habitat (EFH) Assessment as required by the 1996 amendments MSFCMA.

The Corps and the US Coast Guard have determined that the effects of the maintenance dredging of the USCG Cutter *Hudson*'s slip and replacement of Zones 4 and 5 of the bulkheads at USCG Station Miami Beach may adversely affect designated essential fish habitats and habitats of particular concern. The magnitude of the impacts will vary based on the type of habitat ranging from temporary and insignificant to substantial and permanent.

The Corps is serving as the USCG's agent for this action, and will also adopt the results of the consultation for issuance of the Section 10/Section 404 permits from USACE to USCG for the required work. If you have any questions or need further information, please contact Mrs. Terri Jordan-Sellers at 904-232-1701 or by email: Terri.Jordan-Sellers@usace.army.mil.

Sincerely,

Eric P. Summa
Chief, Environmental Branch

Enclosure

This page intentionally left blank

ESSENTIAL FISH HABITAT ASSESSMENT
US COAST GUARD STATION MIAMI BEACH
MIAMI BEACH, MIAMI-DADE COUNTY, FL

In accordance with the Magnuson-Stevens Fishery Conservation and Management Act of 1976 and the 1996 Sustainable Fisheries Act, an EFH assessment is necessary for this project. An EFH is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." *Waters* include aquatic areas and their associated physical, chemical, and biological properties that are used by fishes and may include areas historically used by fishes. *Substrate* includes sediment, hardbottom, structures underlying the waters, and any associated biological communities. *Necessary* means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem. *Spawning, breeding, feeding, or growth to maturity* covers all habitat types used by a species throughout its life cycle. Only species managed under a federal fishery management plan (FMP) are covered (50 C.F.R. 600). The act requires federal agencies to consult on activities that may adversely influence EFH designated in the FMPs. The activities may have direct (e.g., physical disruption) or indirect (e.g., loss of prey species) effects on EFH and may be site-specific or habitat-wide. The adverse result(s) must be evaluated individually and cumulatively. EFH must be identified and described for each life stage and for all species in the fishery management unit (FMU), as well as the physical, biological, and chemical characteristics of EFH, and, if known, how these characteristics influence the use of EFH by each species and life stage [South Atlantic Fishery Management Council (SAFMC) 1998].

1 DESCRIPTION OF THE PROPOSED ACTION

This EFH Assessment covers two important activities that need to be completed for Coast Guard Base (CGB) Miami Beach: 1) Maintenance Dredging of the berth of the US Coast Guard Cutter (CGC) HUDSON and 2) replacement of bulkheads along the eastern and southern side (Zone 4 and Zone 5) of the CGS Miami Beach.

The US Coast Guard Station, Miami Beach is located in Miami-Dade County on a man-made island, on the south side of Melloy Channel (Figure 1 and Figure 2) and north of the main entrance to the Port of Miami, Government Cut. Miami-Dade County is located on the southeast coast of Florida between Fort Lauderdale and the Florida Keys. The County is bounded to the north by Broward County and to the south by Monroe County.

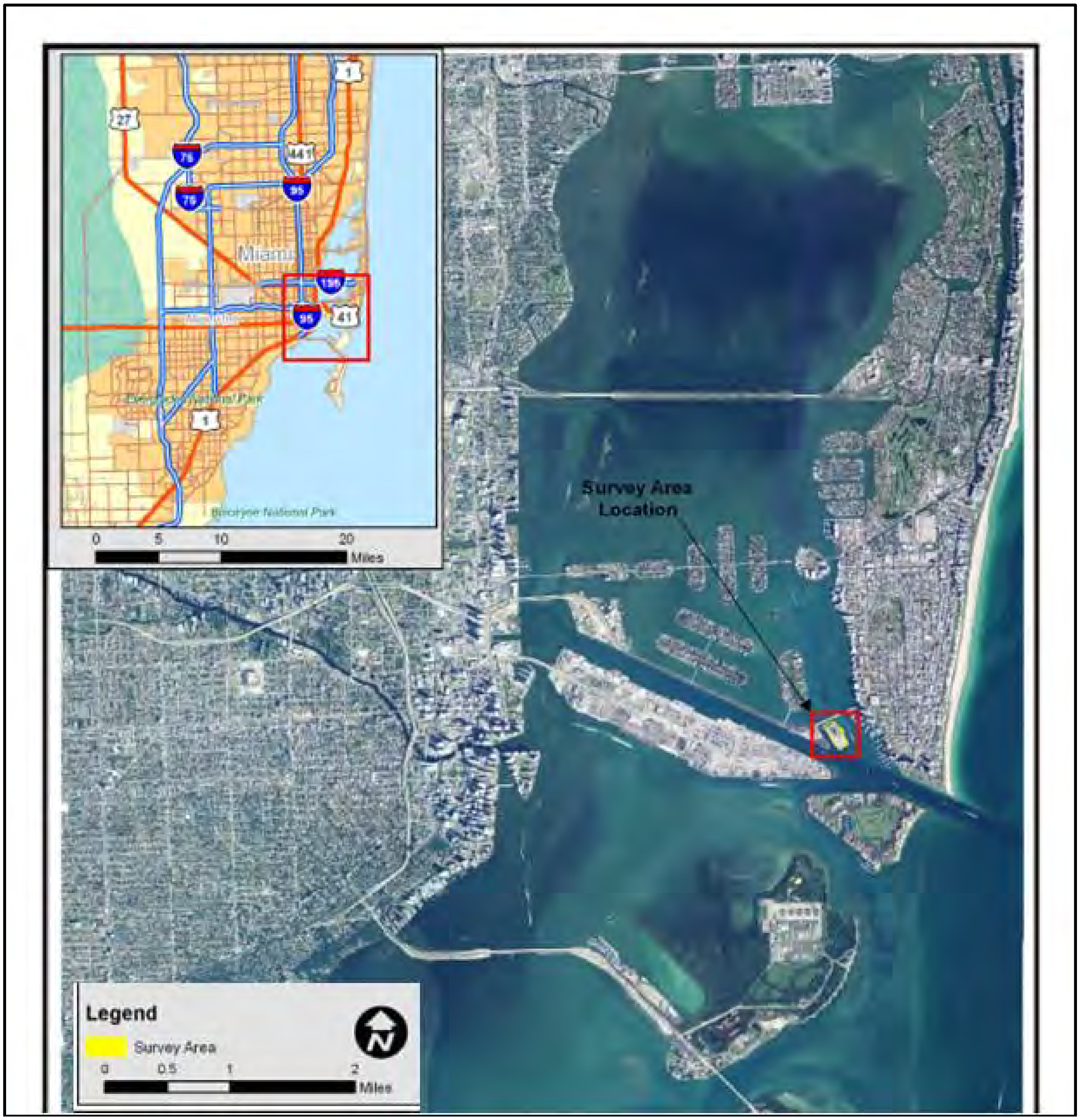


Figure 1 - Location of USCG Base Miami Beach

Figure 2 - USCG Base Miami Beach looking east

Coast Guard Base Miami Beach lies in the north side of Biscayne Bay, a shallow subtropical lagoon that extends from the City of North Miami (Miami-Dade County, Florida) south to the northern end of Key Largo (at the juncture of Miami-Dade and Monroe Counties). Biscayne Bay is bordered on the west by the mainland of peninsular Florida and on the east by both the Atlantic Ocean and a series of barrier islands consisting of sand and carbonate deposits over limestone bedrock (Hoffmeister 1974).

Tides within the Miami area are semi-diurnal having two high and two low tides each day. The mean range at Miami Beach is 2.5 feet (3.0 feet in spring). The lowest tide is 1.4 feet below mean low water (USACE 1989). Maximum tidal current velocities through Government Cut are approximately 5.5 feet per second on average tide, but occasional velocities of approximately 6.2 feet per second have been recorded during spring tide (USACE 1989). These tides are very prevalent at the Coast Guard Base, resulting in very fast moving water in the channels to the north and south of the base.

The Biscayne Bay area, including Coast Guard Base Miami Beach is located within State of Florida Class III waters. Class III is the standard designation covering most open marine waters of the state. Biscayne Bay is also classified as Outstanding Florida Waters (OFW) under Section 62-302.700 of the Florida Administrative Code. The OFW designation carries with it the requirement that ambient water quality cannot be degraded below its existing level.

1.1 HUDSON BERTH MAINTENANCE DREDGING

CGC HUDSON (WLIC-801) (Figure 3) is the second in a series of four of the Coast Guard's most modern inland construction tenders. The primary purpose of the HUDSON and her sister ships is to build, or rebuild if destroyed, those fixed aids to navigation (ATON) used by mariners to safely navigate the inland waters of the United States. HUDSON is responsible for over 1,400 fixed aids to navigation. A fixed ATON is a pile, either wood or steel, that is driven into the bottom, marking the edge of a channel. They can be equipped with a light, day-mark or both.

The HUDSON is berthed on the east side of CGB Miami Beach. The berth is 300 feet long by 85 feet wide. The site was last maintained in early 1995.

The preferred alternative is to dredge the HUDSON's berth to -8 feet MLLW plus up to two feet of allowable overdepth, removing no more than 5,000 cubic yards (CY) of material from the berth and transport the dredged material to the U.S. Environmental Protection Agency (USEPA) designated Ocean dredged Material Disposal Site (ODMDS) located 3.6 miles southeast of the Port of Miami entrance channel. The designated berth is 85 feet wide by 300 feet long and covers 0.59 acres of area (Figure 3). Most of this area consists of a sandy bottom with rock rubble and man-made materials like tires close in to the bulkhead. In the northeast corner of the slip, sea grasses have colonized the shoal material in the slip, since it was last maintained. The sea grasses documented in the slip do not include the threatened species Johnson's seagrass.

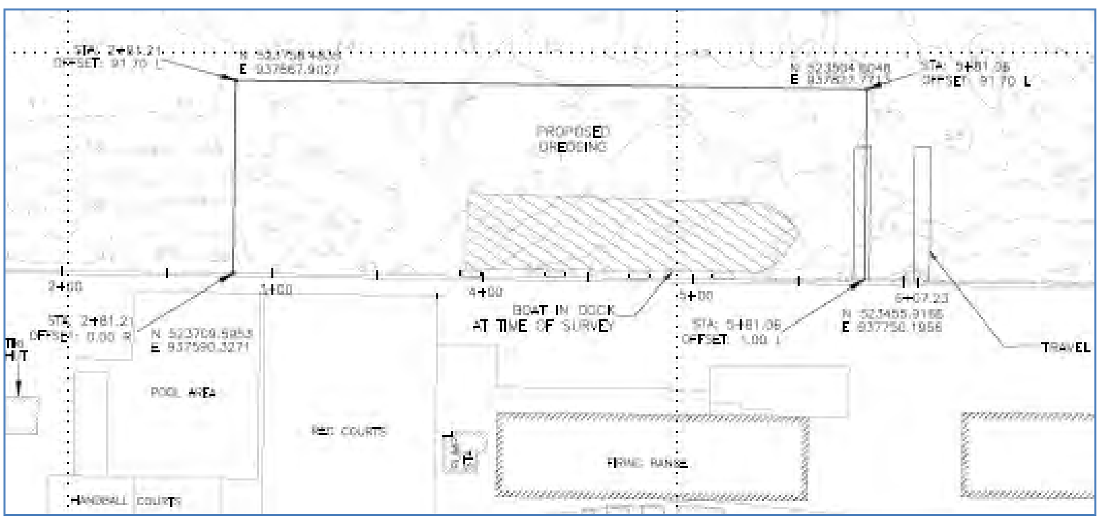


Figure 3 - Schematic Plans showing dredging area for the Hudson berth

Figure 4 - US Coast Guard Cutter HUDSON repairing an ATON at Miami Harbor

1.2 BULKHEAD REPLACEMENT

The current bulkhead is steel sheet pile with a concrete cap, which retains the soil backfill around the entire island. The island was constructed in the 1940's and the east and north bulkheads are original. Additional areas were built out in the 1960's and some sections were replaced in the 1980's.

The Coast Guard uses areas along the bulkhead to moor and support Coast Guard Cutters. Sections of bulkhead have reached the end of their service life such that vehicle loading is restricted on the shore side which impacts the operations of the Cutters. Approximately 1,261 linear feet of bulkhead along the east and south section of the island is scheduled for replacement. The scope of this work will be the replacement of two "zones", or lengths of bulkhead separated by era and type of construction. This work will be completed through a commercial contract administered by Coast Guard Civil Engineering Unit Miami. Typical profiles of the existing bulkheads in Zones 4 & 5 are shown in Figure 5. Zone 5 depths range from 8 to 22 ft while Zone 4 depths range from 4 to 8 feet at Mean Lower Low Water (MLLW).

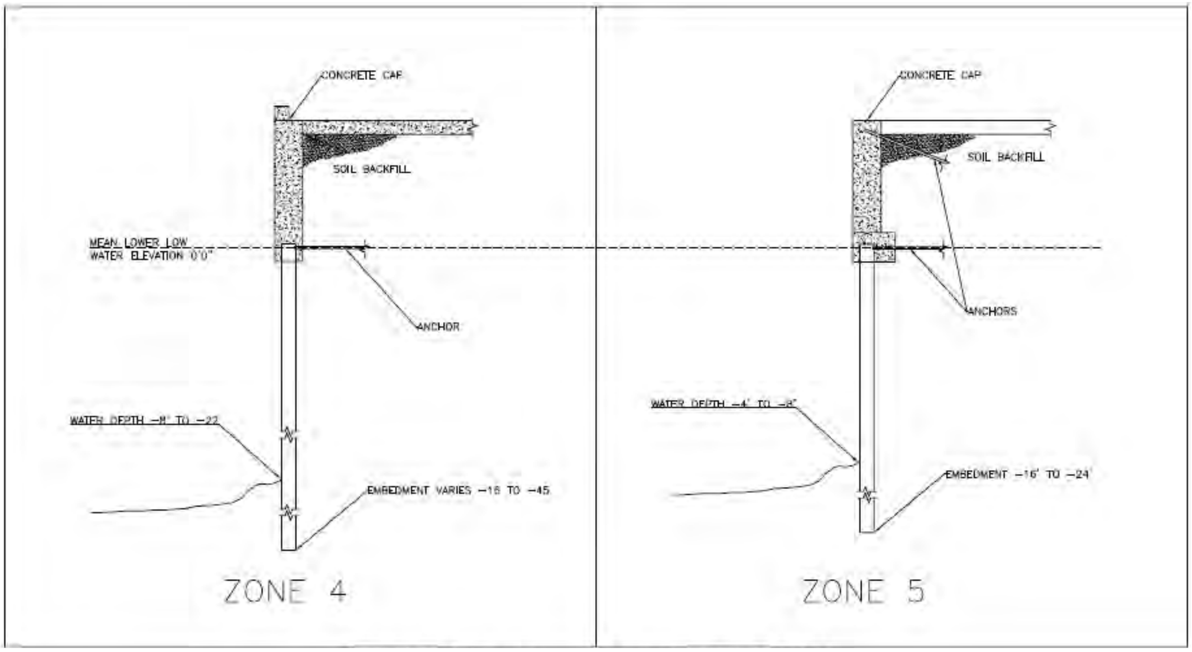


Figure 5 – Typical Existing Condition of Zone 4 & 5 Bulkheads

The preferred alternative for bulkhead replacement is to replace the sections in the most need of repair, specifically Zone 4 and Zone 5 (Figure 6). “Replacement”, in this project, will involve the building-out of new bulkhead from the existing bulkhead, while leaving the old bulkhead in place to become part of the backfill.

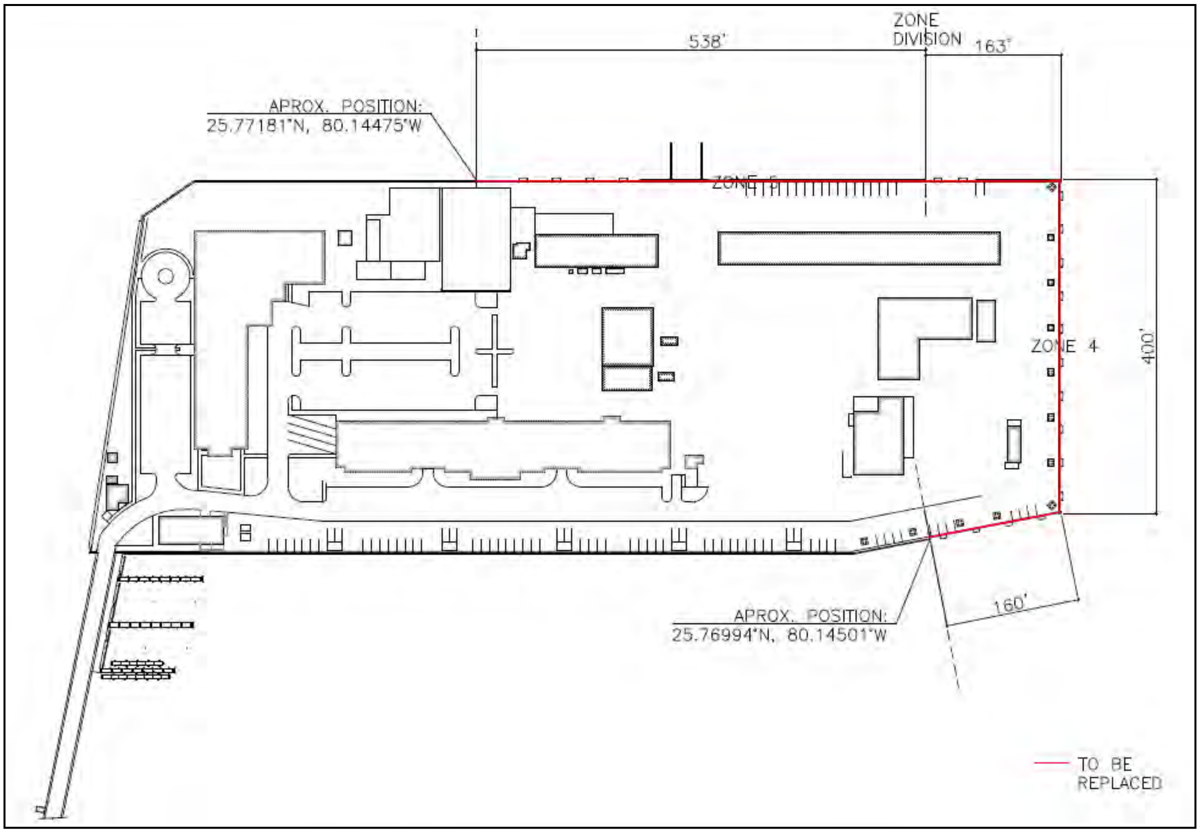


Figure 6 - Plan Sketch of Base Miami Beach with locations of bulkheads to be replaced

The first step in construction will be demolition of the existing concrete cap and the removal of debris and rock toe protection at the foot of the bulkhead (Figure 7, Step 1). Then, new steel sheet pile will be driven in front of the existing sheet pile (Figure 7, Step 2). Total approximate length is approximately 1,260 feet (Figure 6). The new sheet pile will be anchored back to the soil with grouted ground anchors set and tensioned at intervals throughout the zone (Figure 8, Step 3). The area between the new and old bulkhead will be filled with a low psi concrete or other fill material. A new concrete cap will be placed on the new sheet pile. A concrete slab-on-grade on the backfill will be placed, completing the new bulkhead. Sketches and approximate measurements are shown in Figure 8, Step 4.

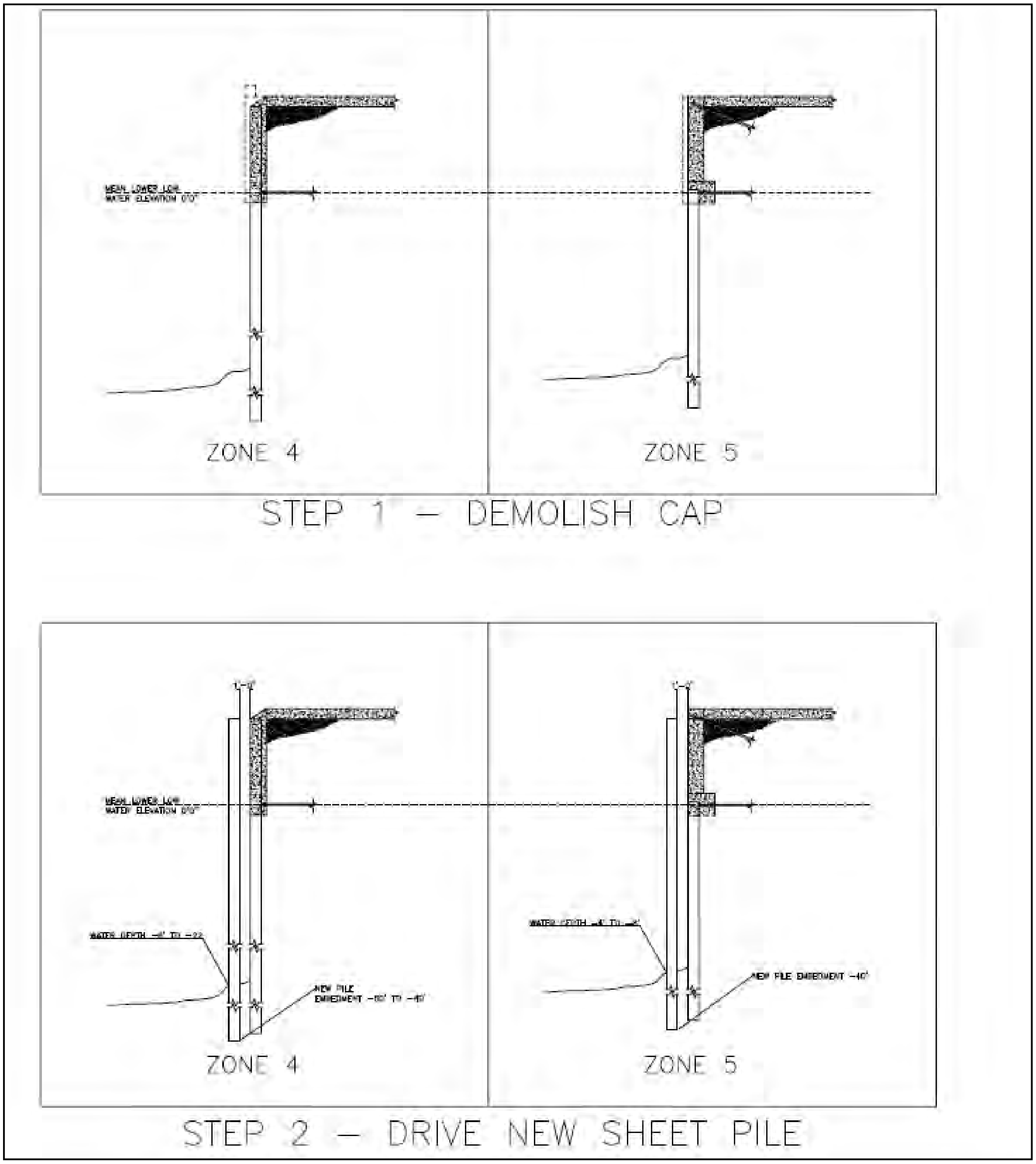


Figure 7 - Construction Steps 1 & 2

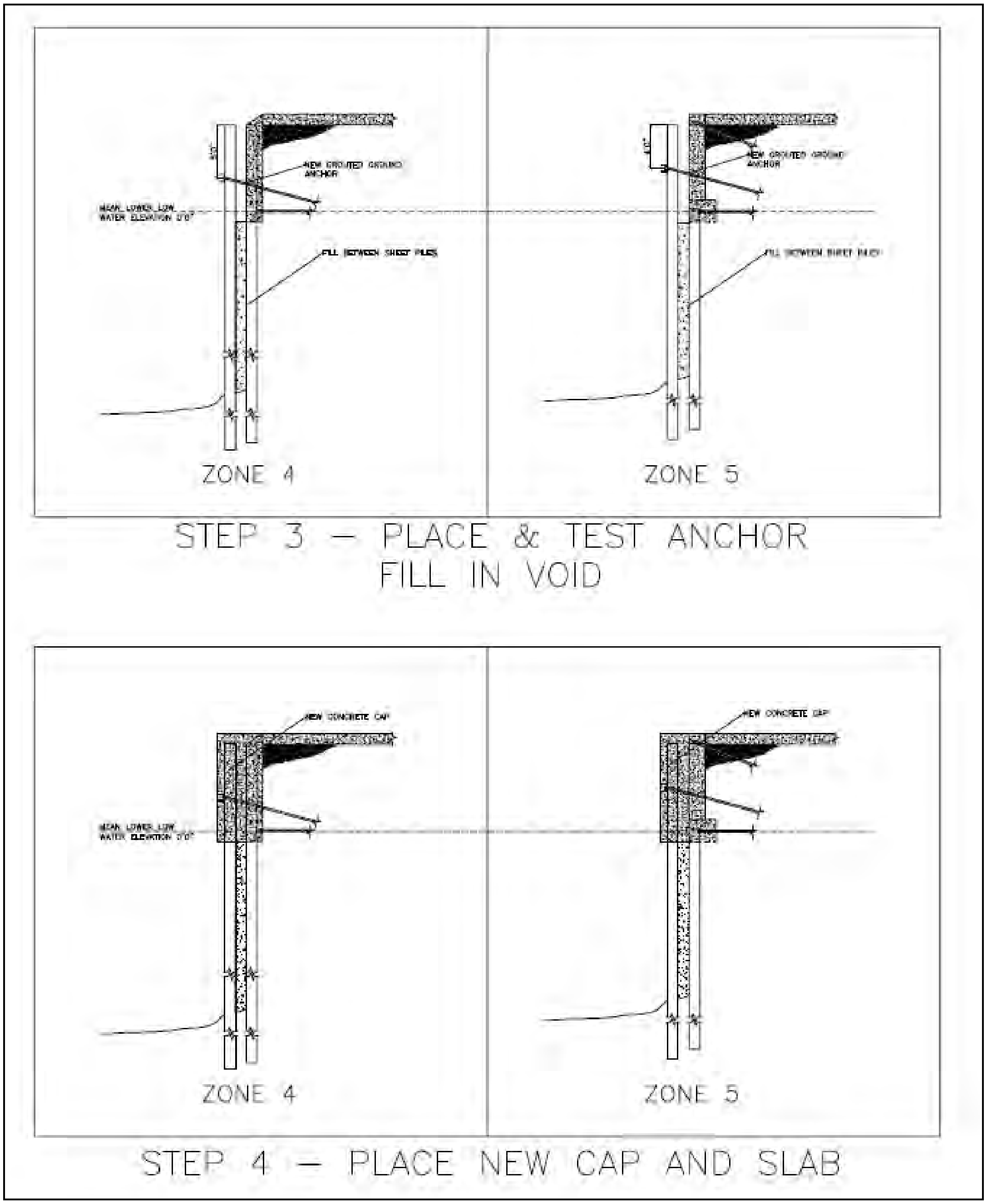


Figure 8 - Construction Steps 3 & 4

Although the government cannot specify the construction method, due to current load restrictions, it is likely that some or all of the pile driving will take place from a work barge with crane and hammer. This barge will likely use spuds or legs placed on the sea bottom to provide stability. Limited utility work will also take place on the shore side to ensure lines and conduit runs are moved if necessary to retain current service with the new bulkhead.

Prior to bulkhead replacement, the USCG will remove healthy stony corals greater than 10 inches in diameter which are able to be removed without breaking the colony, that do not display bleaching, paling or boring sponge infestation. Depending on the total number of corals taken from the bulkhead will be relocated to an approved artificial reef site managed by Miami-Dade County; the Port of Miami's coral relocation site and/or relocation to the Miami Natural History Museum for educational purposes. Any corals smaller than 10cm in diameter or other organisms remaining on the bulkhead may be made available to other non-federal entities for use in research and education at the expense of those entities, (i.e. local universities, non-profit organizations, etc as approved by FWC's permitting program and NOAA-Fisheries PRD Section 10 permitting program, as applicable) as long as the collection of those smaller corals does not result in delays to the bulkhead construction project.

1.3 EFH IN THE PROJECT AREA

The South Atlantic Fishery Management Council (SAFMC) designated corals, coral reefs, hardbottom, seagrasses and unconsolidated sediments as EFH in the project area. Additionally corals and seagrass are designated as Habitats of Particular Concern. Hardbottoms are EFH for coral, red grouper (*Epinephelus morio*), gag grouper (*Mycteroperca microlepis*), gray snapper (*Lutjanus griseus*), mutton snapper (*L. analis*), white grunt (*Haemulon plumieri*), and spiny lobster (*Panulirus argus*). Sand habitats are EFH for cobia (*Rachycentron canadum*), black seabass (*Centropristis striata*), king mackerel (*Scomberomorus cavalla*), Spanish mackerel (*S. maculates*), spiny lobster, and pink shrimp (*Farfantepenaeus duorarum*). All demersal fish species under SAFMC management that associate with coral habitats are contained within the fishery management plan for snapper-grouper species and include some of the more commercially and recreationally valuable fish of the region. All of these species show an association with coral or hardbottom habitat during their life history. In groupers, the demersal life history of almost all *Epinephelus* species, several *Mycteroperca* species, and all *Centropristis* species, takes place in association with coral habitat (SAFMC 2009). Coral, coral reef, seagrass and hardbottom habitats benefit fishery resources by providing food or shelter (SAFMC 1983). SAFMC also designated corals and seagrasses as a Habitat Area of Particular Concern (HAPC), which is a subset of EFH that is either rare, particularly susceptible to human-induced degradation, especially important ecologically, or located in an environmentally stressed area. In light of their designation as EFH-HAPC's and Executive Order 13089, NMFS applies greater scrutiny to projects affecting HAPCs.

Table 1: Federally Managed Species of Fish that May Occur within the Project Area.

Species	Life Stage	Substrate Preference[1]	
		Unconsolidated Sediment	Seagrass
Brown shrimp *Farfantepenaeus aztecus*	A, J, L	A, J, L	J, L
Pink shrimp	A, J	A, J	J

[1] Substrate preference, unconsolidated sediment and seagrass habitats occur in or near the project area.
A=adult; J=juvenile; L=larvae

Farfantepenaeus duorarum			
White Shrimp *Litopenaeus setiferus*	A, J	A, J	J, L
Spiny Lobster *Panulirus argus*	A, J	A, J	A, J
Black seabass *Centropristis striata*	A, J	A, J	
Gag *Mycteroperca microlepis*	A, J	A, J	
Cobia *Rachycentron canadum*	J	J	
Mutton snapper *Lutjanus analis*	A, J	J	J
Gray snapper *Lutjanus griseus*	A, J, L	A, J, L	A, J, L
Lane snapper *Lutjanus synagris*	A, J	A, J	J
Yellowtail snapper *Lutjanus chrysurus*	A, J	J	J
White grunt *Haemulon plumieri*	A, J	A, J	A, J
Sheepshead *Archosargus probatocephalus*	A, J, L	A, J	J, L
Red drum *Sciaenops ocellatus*	A, J, L	A, J, L	J, L
Hogfish *Lachnolaimus maximus*	A, J	J	J
Spanish mackerel *Scomberomorus maculatus*	A, J	A, J	
Black drum *Pogonias cromis*	A, J	A, J	A, J
Southern flounder *Paralichthys lethostigma*	A, J	A, J	J

Table 2: Prey Species that May Occur within the Project Area.

Species	**Life Stage**	**Substrate Preference[2]**	
		Unconsolidated Sediment	**Seagrass**
Thinstripe hermit crab *Clibanarius vittatus*	A, J	A, J	
Horse conch *Pleuroploca gigantea*	A, J	A, J	A, J
Bay anchovy	A, J, L	A, J, L	L

[2] Substrate preference, unconsolidated sediment and seagrass habitats occur in or near the project area. A=adult; J=juvenile; L=larvae

Species	Life	Substrate Preference[2]	
Anchoa mitchilli			
Sheepshead minnow *Cyprinodon variegatus*	A, J, L	A, J, L	
Atlantic menhaden *Brevoortia tyrannus*	A, J, L	A	J, L
Bay scallop *Argopecten irradians*	A, J, L	A, J	A, J, L
Atlantic rangia *Rangia cuneata*	A, J, L	A, J, L	
Quahog *Mercenaria mercenaria*	A, J	A, J	
Grass shrimp *Palaemonetes pugio*	A, J		A, J
Striped mullet *Mugil cephalus*	A, J	A, J	A, J
Spot *Leiostomus xanthurus*	A, J	A	J
Atlantic croaker *Micropogonias undulates*	A, J	A, J	
Silversides *Menidia menidia*	A, J, L	A, J, L	A, J, L
American eel *Anguilla rostrata*	A, J, L	J, L	A, J, L

[1] Substrate preference, unconsolidated sediment and seagrass habitats occur in or near the project area. A=adult; J=juvenile; L=larvae

1.4 CONSTRUCTION METHODOLOGIES

1.4.1 TYPE OF DREDGING EQUIPMENT

The federal government does not normally specify the type of dredging or construction equipment to be used. This is generally left to contractor to offer the most appropriate and competitive equipment available at the time. Never-the-less, certain types of dredging equipment are normally considered more appropriate depending on the type of material, the depth of the area to be dredged, the depth of access to the disposal or placement site, the amount of material, the distance to the disposal or placement site, the wave-energy environment, etc.

Dredging equipment uses either hydraulic or mechanical means to transport material from the substrate to the surface. Hydraulic dredges use water to pump the dredged material as slurry to the surface and mechanical dredges use some form of bucket to excavate and raise the material from the channel bottom. The most common hydraulic dredges include suction, cutter-suction, and hopper dredges and the most common mechanical dredges in the U.S. include clamshells, backhoes, and marine excavator dredges. Public Law 100-329 requires dredges working on U.S. government projects have U.S. built hulls, which can limit the options for equipment types.

Various project elements influence the selection of the dredge type and size. These factors include the type of material to be dredged (rock, clay, sand, silt, or combination); the water depth; the dredge cut thickness, length, and width; the sea or wave conditions; vessel traffic conditions; environmental restrictions; contaminants; other operating restrictions; and the required completion time. All of these factors impact dredge production and as a result costs.

The following discussion of dredges and their associated impacts will be limited to potential dredging equipment suitable for the HUDSON slip dredging, based upon historic review of expansion operations at Port Everglades and similar projects, as well as the expert opinion of the USACE construction and operations staff. The key elements for this project include the following:

- Much of the material that has moved into the berth since it was last maintained in 1995 is sand.
- Significant environmental resources, including corals and associated bulkhead species have colonized the bulkhead adjacent to the berth and sea grasses have colonized the northeast corner of the previously dredged berth.
- The project is located adjacent to a man-made island on a channel with high velocity tidal currents.

The project scale for the HUDSON berth project suggests smaller scale equipment, particularly clamshell or backhoe dredges would likely be used due to the closeness of the bulkhead as well as the finger piers immediately south of the berth which limit access for hopper dredges. Additionally, the berth currently has water depths as shallow as four feet MLLW and since Melloy channel is a high traffic area, the dredging cannot hinder vessel navigation along the channel, limiting the action to smaller scale dredges.

The South Atlantic Division of the US Army Corps of Engineers (which includes the Jacksonville District) completed a regional consultation for the use of all types of dredges throughout the southeast Atlantic from the Virginia-North Carolina state line to Key West, Florida. This consultation resulted in a regional biological opinion (referred to as the “SARBO” (South Atlantic Regional Biological Opinion)) for the use of all dredge types in USACE-maintained or USACE-permitted (as is the case with this maintenance dredging) dredging projects and provided for protective measures USACE was required to reduce the likelihood of turtle entrainment. Appropriate Terms and Conditions from the SARBO will be incorporated into the dredging contract plans and specifications based on the potential dredge types proposed for this work.

1.4.1.1 Mechanical Dredging

Mechanical dredges are classified by how the bucket is connected to the dredge. The three standard classifications are structurally connected (backhoe), wire rope connected (clamshell), and chain and structurally connected (bucket ladder). The advantage of mechanical dredging systems is that very little water is added to the dredged material by the dredging process and the dredging unit is not used to transport the dredged material. This is important when the disposal location is remote from the dredging site. The disadvantage is that mechanical dredges require sufficient dredge cut thickness to fill the bucket to be efficient and greater re-suspended sediment is possible when the bucket impacts the bottom and as fine-grained sediment washes from the bucket as it travels through the water column to the surface. Clamshell or backhoe marine excavators are likely to be employed on the HUDSON berth maintenance dredging.

Clamshell Dredge.

Clamshell dredges (Figure 9) are the most common of the mechanical dredges. Clamshell dredges use a number of different bucket types for mud, gravel, unconsolidated rock, or boulders. The clamshell dredging operation cycle is to lower bucket in open position to bottom surface, close bucket penetrating material with weight of bucket, raise bucket above hopper level, swing, dump, swing, and repeat. The length of the wire to lower the bucket limits the dredging depth and production depends upon the bucket size, dredging depth, and type of material. The dredged material is placed in a scow or on a barge for transport to the disposal site. Clamshell dredges are able to work in confined areas, can pick up large particles, and are less sensitive to sea (wave) conditions than other dredges. The dredge requires a tug to move it to and from a location. Potential clamshell dredging environmental impacts in unconsolidated sediments include resuspension of sediments when the clamshell drops on to the bottom and as material washes from the bucket as it rises through the water column. Operational controls such as reducing the bucket speed as it drops to the bottom and as it rises through the water column may reduce impacts, as well as use of a closed bucket system. An animation showing the operation of a clamshell is located online at http://el.erdc.usace.army.mil/dots/trip.html.

Photo Courtesy of Great Lakes Dredge & Dock Company

Figure 9 - Clamshell Dredge (left) with Scow (right)

Animation showing how a clamshell operates is located on the following website - http://el.erdc.usace.army.mil/dots/trip.html.

Backhoe Marine Excavator

A backhoe dredge is a *back-acting* excavating machine that is usually mounted on pontoons or a barge (Figure 10). The backhoe digs toward the dredge with the bucket penetrating from the top of the cut face (Figure 11). The operation cycle is similar to the clamshell dredge, as are the factors affecting production. Backhoe marine excavators have accurate positioning ability and are able to excavate firm or consolidated materials. However, they are susceptible to swells and have low to moderate production. The dredging depth for backhoe marine excavators is limited to the reach of the excavator arm. The dredge also requires a tug to move to and from a location.

Figure 10 - Backhoe excavator dredge

Figure 11 - Backhoe loading a scow

Potential environmental impacts of backhoe marine excavators dredging unconsolidated sediment are similar to those of a clamshell dredge, as are the operation controls to reduce inadvertent impacts. The key is slowing the movement of the bucket through the water.

Both types of mechanical dredges require transport barges to move the dredged material from the dredge to the disposal site. The type and size of barges will depend upon the distance to the disposal site and the production rate of the dredge. Barges are less expensive than dredges, therefore, the operation is generally designed so that the dredge is always working and does not experience down time waiting for a barge to be available to load. Barges or bottom dump scows may be used to transport dredged material to the ODMDS for disposal.

Potential barge environmental impacts could occur as the barge is loaded if material is allowed to spill over the sides, during transport if the barge leaks material, and during disposal if the material escapes from the disposal area. Operational controls eliminate spilling material during loading by monitoring the dredge operator to make sure that the dredge bucket swings completely over the barge prior to opening the bucket. Requiring barges in good repair with new seals minimizes leaking during transport, and monitoring changes in draft throughout the transport allows for determination of leaking scows for each and every load of material being transported to the disposal site. Operating in compliance with the Site Management and Monitoring plan prepared by USEPA for the ODMDS would minimize environmental impacts during disposal. The barges would be required to use positioning equipment to place dredged material within the designated ODMDS and inspectors may be required to monitor disposal activity.

1.4.1.2 Hydraulic Dredging

Hydraulic dredges mix dredged material into a sediment-water slurry and pump the mixture from the bottom surface to a temporary location such as a barge or re-handling site, or to a permanent location such as a confined or unconfined upland or aquatic site. The advantage of hydraulic dredges is that there is less turbidity (re-suspended sediments) at the dredge than with mechanical dredges. The disadvantage of hydraulic dredges is that a large quantity of water is added to the dredged material and this excess water must be dealt with at the disposal location. Examples of hydraulic dredges include hopper dredges and cutterhead dredges.

Cutter-Suction Dredge

Cutter-suction dredges (Figure 12 and Figure 13), or cutterhead dredges, are mounted on barges. The cutter suction head resembles an eggbeater with teeth that mobilizes the dredged material as it rotates. The mobilized material is hydraulically moved into the suction pipe for transport. The cutter suction head is located at the end of a ladder structure that raises and lowers it to and from the bottom surface. The cutter suction dredge moves by means of a series of anchors, wires, and spuds. The cutter suction dredges as it moves across the dredge area in an arc as the dredge barge swings on the anchor wires. One corner of the dredge barge is held in place by a spud and the dredge rotates around that spud. The dredge requires workboat or tug assistance to move the anchors and a tug is required to move the dredge to and from a location. Some cutter-suction dredges have spud carriages that allow the dredge to be moved forward without the assistance of tugs. The discharge pipeline connects the cutter suction dredge to the disposal area. The dredged material is hydraulically pumped from the bottom, through the dredge, and through the discharge pipeline to the disposal area. This is generally an upland site, but can be a barge for transport to a remote location or an in-water site. Dredge pumps are located on the barge with additional pump(s) often located on the ladder, especially for deep water dredging projects. Cutter-suction dredges are limited to dredging depths within reach of the ladder. Cutter-suction dredges come in a variety of sizes from very small (8 inches) to very large (36 inches) and are described based on the diameter of the pipeline of the discharge pipeline. For the HUDSON berth project, if a cutterhead dredge is used, it would have to be a very small cutter-suction dredge.

Figure 12 - Hydraulic cutterhead dredge vessel

Photo/drawing: Engineer Research and Development Center 2007

Figure 13 - Cutterhead Dredge Contacting Substrate

Potential environmental impacts from cutterhead dredges include localized suspended sediment along the bottom around the cutterhead and fine-grained sediment turbidity plumes from barge overflow or pipeline leaks. Overflow and leaks can be reduced or eliminated by restricting the amount of overflow time, eliminating barge overflow, and performing regular inspections of the pipeline. Locating barges the furthest possible distance from resources can further reduce environmental impacts. Anchors are placed to both sides of the cutterhead dredge to provide the ability to swing the dredge. The anchors are placed using a crane on a workboat.

Video clips of how cutterhead dredges operate are located on the following website: http://el.erdc.usace.army.mil/dots/trip.html.

1.4.1.3 Dredge Material Transport Vessels

Both types of barges discussed below are typically pushed or pulled to the disposal site by a tug (Figure 14).

Split Hull Barge

A split hull barge (Figure 14 and Figure 15) has two hulls connected with hinges at the front and back. The two-door hinged configuration, allows the hulls to swing apart, opening at the bottom to allow dredged material to fall from the barge. This provides a rapid disposal of dredged material, which, as a result, is placed within a small area. The rapid descent of material through the water column reduces the potential for resuspension of sediments into the water column during disposal. Such a barge may be used for ODMDS disposal. A rubber seal (similar to a gasket or weather-stripping on a door), is pinched between the two doors, limiting the leakage of water and dredged material from the barge. This seal does not prevent 100% of water and dredged material from leaking; however it minimizes it to the maximum extent practicable. During transport, the barge's draft and ullage are monitored and recorded and this data is reviewed after each load to detect loss of draft, which is assumed to represent loss of material. If a barge has a net loss of more than one foot in draft between the dredge site and disposal site(s) (averaged between the bow and stern monitoring locations), this serves as a "red flag" to conduct an investigation as to why the draft loss occurred. If the draft loss can be determined due to high seas and sloshing of material, no other action is required. However, if the loss is not as a result of high seas and sloshing, the barge is temporarily removed from the rotation and has the seals tested and repaired (if necessary). If a particular barge demonstrates a trend of material loss that does not resolve itself after seal testing and repair, the barge is removed from the dredging operation. One-foot of loss has been determined by USACE and USEPA to be a good threshold for notification, because all barges have some amount of draft loss through leakage or water sloshing out of the barge due to sea conditions and weather, although the amount is typically minimal.

Bottom Dump Barge

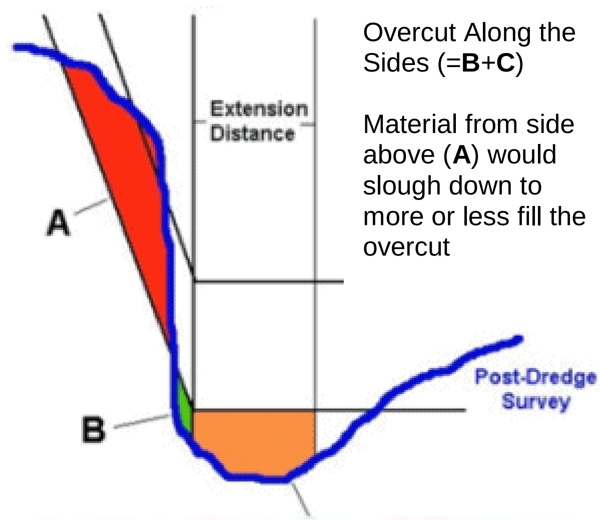
A bottom dump barge has doors on the bottom of the hopper, which opens at the disposal site to allow the dredged material to fall to the bottom. This type of barge has slower disposal than split hull dump barges and material spreads over a larger area. This barge may be used for ODMDS disposal. As with split hull barge, the bottom dump barge has seals around each of the doors to minimize leakage of material and water from the barge. The barge is monitored in the same method as the split hull barge and the same response is taken if the barge loses more than a net foot of draft.

Dredged materials are placed in the bottom dump and split hull barges using either a pipeline, a bucket or backhoe dredge, where one is loaded at a time or via a device called a “spider-barge” (Figure 26) which allows two barges to be in different states of loading (one being loaded, while one settles while a third is transiting to and from the disposal site) and is a much more efficient system for loading barges. For split hull and bottom dump barges, the disposal action is triggered remotely from the tug to the barge. The exact time the signal is given to the barge, and when the doors open and close are recorded in a tracking system for further data analysis and compliance monitoring.

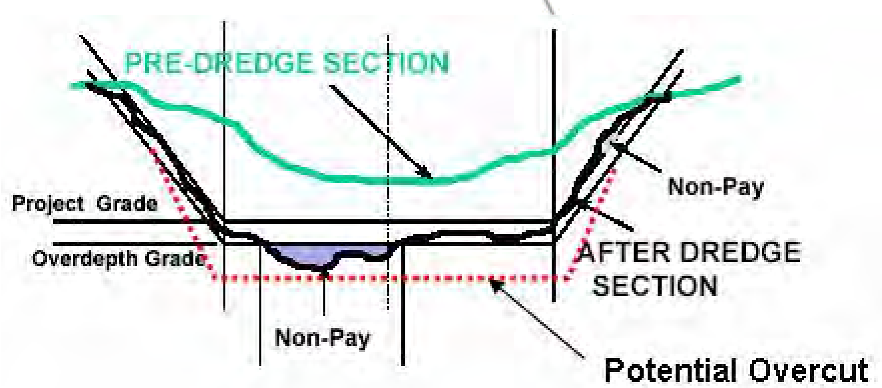
Figure 14 - Split Hull Barge Being Pushed by Tug

Figure 15 - View of Stern of Split-hull Scow

1.4.2 REQUIRED, ALLOWABLE, AND OVER-CUT BEYOND THE PROJECT DEPTH OR WIDTH



The plans and specifications normally require dredging beyond the project depth or width. The purpose of the "required" additional dredging is to account for shoaling between dredging cycles (reduce the frequency of dredging required to maintain the project depth for navigation). In addition, the dredging contractor is allowed to go beyond the required depth. This "allowable" dredging accounts for the inherent variability and inaccuracy of the dredging equipment (normally ±2 feet). In addition, some mixing and churning of material below the channel bottom may occur (especially with a large cutterhead). Generally, the larger the equipment, the greater the potential for mixing of material below the "allowable" channel bottom. Some of this material may become mixed-in with the



dredged material. If the characteristics of the material in the overcut and mixing profile differ from that above it, the character of the dredged material may be altered. The quantity and/or quality of material for disposal or placement may be substantially changed depending on the extent of over-depth.

1.4.3 POST-DREDGE CLEAN UP OPERATIONS: USE OF A DRAG BAR

Since dredging equipment does not typically result in a perfectly smooth and even bottom (see discussion above); a drag bar, chain, or other item may be drug along the bottom to smooth down high spots and fill in low spots. This finishing technique also reduces the need for additional dredging to remove any high spots that may have been missed by the dredging equipment. It may be more cost effective to use a drag bar or other leveling device (and possibly less hazardous to sea turtles than additional hopper dredging).

Since dredging equipment does not typically result in a perfectly smooth and even bottom (see discussion above); a drag bar, chain, or other item may be pulled along the bottom to smooth down high spots and fill in low spots. This finishing technique also reduces the need for additional dredging to remove any high spots that may have been missed by the dredging equipment. It may be more cost-effective to use a drag bar or other leveling device (and possibly less hazardous to sea turtles) than to conduct additional hopper dredging (Figure 16 and Figure 17) courtesy Bean Dredging Company and Weeks Marine Incorporated).

Figure 16 - Dual-block Drag Bar

Figure 17 - Davit-mounted Drag Bar

1.4.4 BULKHEAD CONSTRUCTION METHODS

Because sheet pile walls and bulkheads derive their support from the surrounding soil, an investigation of the foundation materials along the wall alignment shall be conducted prior to design of the bulkhead. This investigation shall be a cooperative effort among structural and geotechnical engineers and shall include an engineering geologist familiar with the area. Based on previous investigations, the soil below Coast Guard Station Miami Beach is sand on top of limestone. This limits pile driving to those systems able to penetrate rock, typically hammer driven systems. Hammers can generally be divided into two groups, impact and vibratory. Impact hammers may be lifted manually or automatically by steam, air or diesel, and may also be single or double-acting. These hammers are sized by the maximum "rated energy" (foot-pounds) theoretically contained as kinetic energy in the ram just before impact. This rated energy is not necessarily absorbed by the pile. Vibratory hammers are electrically or hydraulically powered, usually have a variable operating frequency range (vibrations per minute), and are generally rated by "eccentric moment" (inchpounds) and "driving force" (tons) for a specified frequency. A more detailed description of the types of Hammers is available for review in the Corps of Engineers Engineering Manual EM1110-2-2906, Chapter 5 (http://www.publications.usace.army.mil/Portals/76/Publications/EngineerManuals/EM_1110-2-2906.pdf).

Installation of the new bulkhead includes driving new pilings into the seafloor. A pile driving template will be mounted to the crane barge. This allows the crane barge to control the alignment of the piles as they are driven. Once the crane barge is properly aligned, the piles will likely be driven to the appropriate depth using a vibratory hammer similar to that used in other bulkhead installations such as shown in Figure 18. An impact hammer will be a contingency employed only if vibratory methods are inadequate.

Figure 18 - Vibratory Installation of Sheet Piles

At present, underwater ambient noise in the project area is likely to be dominated by sounds from normal operations at the Coast Guard Base as well as vessels moving through Government Cut at the Port of Miami and Mellow channel which are adjacent to the Coast Guard Station. These noises will be close to the construction source and will continue during and after the proposed action. These sounds are non-impulsive and intermittent, occurring sporadically during normal activities. Noise from vibratory pile driving associated with the proposed action is unlikely to alter the existing ambient noise within the project area because of its relatively low source level (approximately 157 dB re 1 µPa rms at 10 m) and non-impulsive nature. Noise from impact pile driving has higher source levels (approximately 186 dB re 1 µPa at 10m) and is impulsive in nature, with a fast rise time and multiple short-duration (50–100 millisecond; Illingworth & Rodkin 2001) events.

2 RESULTS OF ON-SITE INSPECTIONS TO EVALUATE THE HABITAT AND THE SITE-SPECIFIC EFFECTS OF THE PROJECT

2.1 VEGETATION

Seagrass distribution and occurrence in the project vicinity were determined from the FWC seagrass GIS layers (Figure 19). Although no seagrass is shown in Melloy channel or in the vicinity of the USCG Base Miami Beach, previous surveys south of the Base conducted for the Miami Harbor expansion documented seagrass in Melloy Channel where it meets Fisherman's

Channel (Figure 20). Because there were previously mapped seagrasses in Melloy Channel, the decision was made to perform an in-situ survey for sea grasses in the berth as well as within 15 feet of the bulkheads surrounding the base.

Figure 19 - FWC Seagrass data in vicinity of Coast Guard Base

Figure 20 - Mapped seagrass south of USCG Base Miami Beach in Melloy Channel

A seagrass survey was conducted from May 28-30, 2013 including the entire perimeter of the Station within 4.6 meters (m) (15 feet) of the station and a sufficient buffer to account for side slope, with transects spaced 15.2m (50 feet) apart, perpendicular to the bulkhead. The berth of the USCG *Cutter Hudson*, located on the eastern side of the station was surveyed for seagrasses out to 30m (98 feet) (Figure 21).

Figure 21 - Seagrass Survey Transect Locations

Approximately 0.42 acres of seagrasses were documented within and adjacent to the slip to be dredged betweeen 16m (52.5 feet) and 30m (98 feet) from the east bulkhead wall adjacent to the *Cutter Hudson* berth. The predominant seagrasses were *Halophlia decipiens* and *Halodule wrightii*, although *Syringodium filiforme* and *Thalassia testudinum* were also present. No *H. johnsonii* was documented in the survey. Despite surveying seagrass transects around the entire island, no seagrasses were found anywhere else in the project area (Figure 22). A copy of this survey is included with this EFH Assessment.

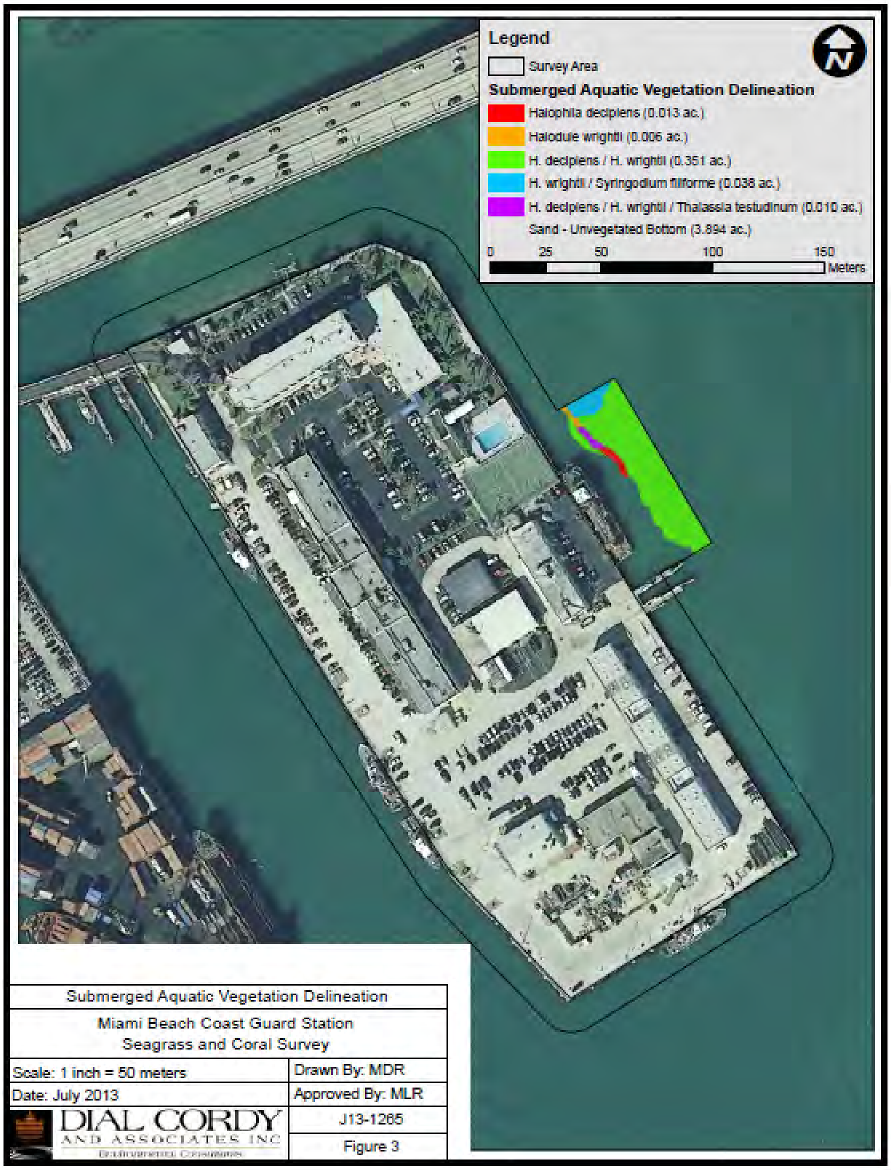


Figure 22 - Seagrass Location in Project Areas

2.2 SCLERACTINIAN CORALS

A survey for scleractinian corals was conducted along the entire bulkhead, from the base of the bulkhead wall to the mean low water mark. Scleractinian coral data collected included coral species, size, orientation, latitude, longitude and height on the bulkhead wall. Surveys were conducted from May 28-30 and June 12, 2013 in support of the FDEP permit application for dredging around the station and bulkhead improvements. A copy of this survey is included with this EFH Assessment.

Coral surveys resulted in the documentation of 580 scleractinian coral colonies on all four bulkhead walls. Of these, 197 (33%) exceeded 10cm in their greatest (longest) measured dimension. The total area of wall surface covered by all 580 corals is 50.2 m^2. This is approximately 0.2% of the surface area available for colonization that is below mean low water. In total 18 species of scleractinian coral were identified. These species are commonly identified on the reefs and hardbottom communities of southeast Florida (Jaap 1984; Porter 1987). Of these, *Oculina diffusa* was the most common coral comprising 66% of all coral species present. *O. diffusa* also comprised more than half of all large (>10cm) corals, however, the three largest individual colonies identified were *Porites astreoides*. The density of corals was greatest on the south wall and the south parts of the east and west walls. Coral density decreased on the northern reaches of the east and west walls. The density on the west wall was lower than on the south and east walls.

Additional scleractinian corals were noted at the base of the north, east and south walls, where they have colonized rubble and debris. Although these coral were not quantified under this contract, pre-construction surveys should include this area, as many of these corals were larger than 10cm and would be considered as candidates for relocation.

Figure 23 - Coral Locations on the Bulkhead

3 ANALYSIS OF THE POTENTIAL ADVERSE EFFECTS (INDIVIDUAL AND CUMULATIVE) OF THE ACTION ON EFH AND THE MANAGEMENT SPECIES INCLUDING PERTINENT LITERATURE AND RELATED INFORMATION

3.1 FISHES

Fish species are expected to be near the Coast Guard station bulkheads. This is a common occurrence in south Florida because fish are attracted to vertical structure. Based on blasting conducted at the Port of Miami in 2005 directly adjacent to bulkheads in the port, species that are expected to be close to the bulkheads at the Coast Guard Base include the 24 different genera (30 species) listed in Table 3. The species with the highest abundance were white grunts; scrawled cowfish and pygmy filefish.

Table 3 - Fish Species Collected during Blasting Operations near the Port of Miami Bulkheads (2005)

Common Name	Scientific Name	Common Name	Scientific Name
Atlantic thread herring	Opisthonema oglinum	bandtail puffer	Sphoeroides spengleri
bigeye scad	Selar crumenopthalmus	black grouper	Mycteroperca bonaci
blackwing sea robin	Prionotus rubio	bluestriped grunt	Haemulon sciurus
cardinalfish	Astropogon spp	dwarf sand perch	Diplectrum bivittatum
Filefish	Aluterus spp	french grunt	Haemulon flavolineatum
gag grouper	Mycteroperca microlepis	gray angelfish	Pomacanthus arcuatus
gray triggerfish	Balistes capriscus	Hogfish	Lachnolaimus maximus
lane snapper	Lutjanus synagris	Lookdown	Selene vomer
mangrove snapper	Lutjanus griseus	Mojarra	Eucinostomas spp
mutton snapper	Lutjanus analis	Porkfish	Anisotremus virginicus
pygmy filefish	Monocanthus setifer	queen angelfish	Holocanthus ciliaris
red grouper	Epinephelus morio	scrawled cowfish	Lactophrys quadricornis
silver jenny	Eucinostomas gula	spotfin mojarra	Eucinostomas argenteus
tomtate	Haemulon aurolineatum	white grunt	Haemulon plumieri
yellow jack	Caranx bartholomaei	yellowfin mojarra	Gerres cinereus

The proposed action includes the replacement of the old bulkhead and associated disturbance of the water column. Highly mobile juvenile or adult fish would be able to move quickly away from the disturbance. However, fish associated with attached macroalgae and sedentary invertebrates on the old bulkhead structures will be displaced until the community is re-established on the new bulkhead; attached macroalgae EFH will quickly recolonize the bulkhead structures (<1 year). The small area of unconsolidated substrate EFH in the affected area will be minimally disturbed in the replacement of the vertical structures, but highly disturbed by the dredging. However, the dredging impact on subtidal bottom would be very temporary in duration (e.g., altering depth of sand bottom).

3.2 SEAGRASSES

Of the mapped 0.42 acres of sea grasses within the survey area, 0.13 acres (6,500 square feet) falls within the direct dredging footprint and sideslope equilibration area associated with the dredging and would be removed by the dredging (Figure 25).

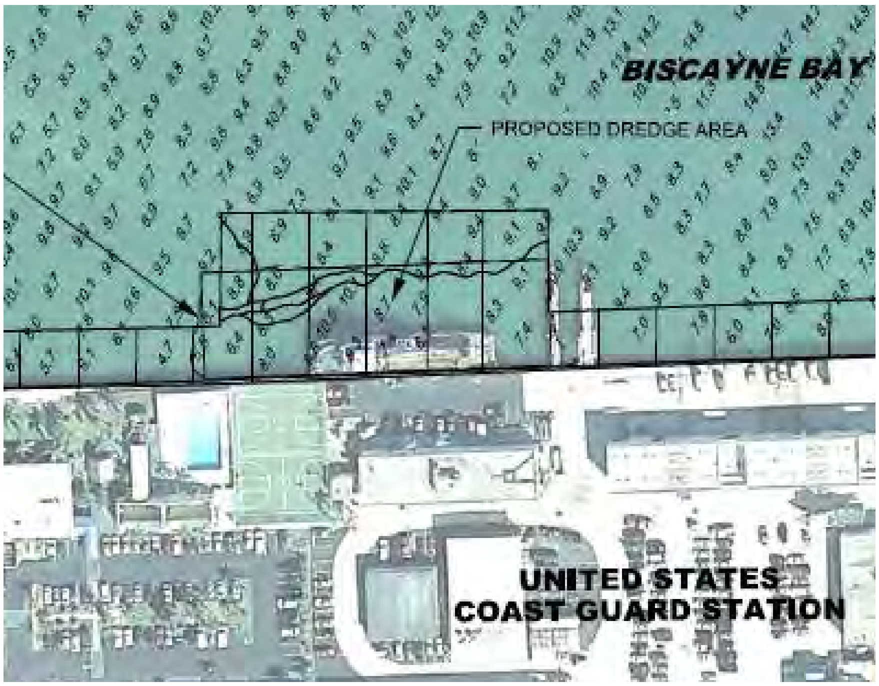


Figure 24 - Seagrass Impact Graphic

3.3 CORALS

3.3.1 DREDGING

Maintenance dredging the slip will cause temporary increases in turbidity where dredging is taking place. The State of Florida water quality regulations require that water quality standards not be violated during dredging operations. Various protective measures and monitoring programs will be conducted during construction to ensure compliance with state water quality standards. Should turbidity exceed state water quality standards during construction, as determined by monitoring, the contractor will be required to cease operations until conditions return to normal. Corals located on the bulkhead adjacent to the dredging area will be exposed to increased turbidity and potential sedimentation during dredging of the slip. This is similar to the sedimentation and turbidity as a result of propeller resuspension of the sediments that have filled in the Hudson's slip. Due to the short duration of the dredging, because of the low volume of material to be removed from the slip, the effects of this sedimentation and turbidity exposure on the corals on the bulkhead adjacent to the slip is expected to be minimal.

3.3.2 BULKHEAD REPLACMENT

With the replacement of Zones 4 & 5 of the bulkheads, a subset of the mapped 580 corals of 18 different species would be impacted by the bulkhead replacement. The survey of the complete bulkhead around the station identified 197 corals equal to or greater than 10cm in diameter, making them candidates for relocation. The final numbers of corals to be relocated would be determined immediately prior to bulkhead replacement, and some changes to the corals on the bulkhead may be documented due to vessels mooring alongside the bulkheads, natural mortality or other events which may have removed them since the June 2013 survey. Any corals relocated off of the bulkhead may be offered to non-federal parties for education and research purposes and/or may be relocated to a previously permitted relocation site managed by either Miami-Dade County DERM or the Port of Miami. This will leave up to 383 corals documented in the June 2013 survey which were less than 10cm in diameter (too small to ensure successful relocation) which may remain on the bulkhead at the time of construction. There is no guarantee that these smaller corals will be relocated and for the purposes of analysis as assumed to be lost from the ecosystem until sufficient time passes for corals of similar size and species composition to colonize the new bulkhead once replacement is complete.

Prior to initiation of any dredging activities, the USCG will require the contractor to relocate any colonies of proposed to be listed species greater than 10cm located on the bulkheads proposed to be replaced. The 10 cm size was chosen in consultation with coral relocation experts (Dr. Keith Spring, CSA pers comm.) who conveyed that corals smaller than 10cm are often flatter and more easy broken during relocation efforts. The collections and relocations will be made by coral experts and trained professionals.

3.4 EFH FISH SPECIES

3.4.1 MAINTENANCE DREDGING

Dredging with mechanical dredges has not been documented as effecting fish, their eggs or their larvae. Dredging with hydraulic dredges usually results in little to no effect on adult fishes due to their size and ability to avoid either the drag head or cutterhead. The same cannot be said of larval fishes and eggs, which lack the ability to avoid the suction near the drag head or cutterhead. Larvae and egg distribution and concentrations in a channel are highly variable on a range of scales (spatially and temporally). Therefore it is important to recognize that not all larvae in an inlet like Port Everglades would be vulnerable to entrainment. Larvae and eggs are not equally distributed in the inlet as the tidal lows in and out of the inlet can show asymmetry. In addition, many larvae exhibit a vertical migration strategy that facilitates tidal stream transport. That is, larvae are up in the water column during flood and descend to near the bottom during ebb; such behavior helps to prevent larvae from being flushed back out the inlet (Settle 2003).

Settle (2003) discussed NOAA/NOS' National Centers for Coastal Ocean Science report entitled *Assessment of Potential Larval Entrainment Mortality Due to Hydraulic Dredging of Beaufort*

Inlet. NOAA found, and USACE agrees that "any larvae entrained in the dredge are likely to be killed; it is likely that the impact at the population level would be insignificant" (Settle 2003). In this assessment, NOAA also determined that the use of a 30-inch hydraulic dredge dredging 24-hours a day in Beaufort Inlet, North Carolina, would result in entrainment mortality "even under the worst case scenario" of 0.1% per day where there are high densities of larval fishes (up to 5 larvae per m^3). This may be informative of potential impacts at CG Base Miami Beach, although it is far from Beaufort Inlet. Therefore, USCG assumes that if an inlet such as Beaufort with high densities of larval fishes can be dredged for 24-hours-a-day without significant population level impacts to larval fish densities, that the same would hold true at CG Base Miami Beach, where a significant portion of the larval development habitat is in the nearshore and offshore to the north and south of the Port (USACE 2003). Additionally the volume of material to be dredged is minor (less than 5,000 CY) which also greatly reduces any potential impacts due to the small amount of time needed to complete the dredging.

Although the above may be useful for appreciating the effects of hydraulic dredges, quantitative information on the effects of mechanical dredge types on fish, larvae, or eggs is not available to date.

3.4.2 BULKHEAD REPLACEMENT

Individual fish near the bulkhead replacement work may also experience sound intensities that could affect their behavior or damage their hearing ability. Since many fish use their swim bladders for buoyancy, they are susceptible to rapid expansion/decompression due to peak pressure waves from underwater noises (Hastings and Popper 2005). The onset of injury threshold resulting from this rapid expansion/decompression is supported by data presented on selected species in FHWG (2008). Whereas behavioral disturbance criteria for fish are not supported with data, the NMFS and USFWS generally use 150 dB rms as the threshold for ESA-listed species. Criteria for behavioral impacts and onset of injury are provided in Table 3.

The criteria suggest only the most limited mortality of fish, and only when they are very close to an intense sound source (FHWG 2008). There is no population-level impact on unregulated fish anticipated from the sound intensities modeled and only minimum and temporary adverse impacts on water column EFH for all managed species inhabiting the water column.

Table 4 - Criteria for Fish Behavioral Disturbance and Onset of Injury from the Sound Produced by Vibratory and Impact Hammers

Pile Type	Driving Method	Threshold	Distance (m)[1]	Area (km^2)
Steel (sheet and king piles)	Vibratory	Behavioral (all):150 dB re 1 μPa rms	73.6	0.011
	Impact (contingency)	Injury (all): 206 dB re 1 μPa rms	8.6	0.00058
		Injury (≥ 2g): 187 dB re 1 μPa^2sec SEL	21.6	0.0019
		Injury (< 2g): 183 dB re 1 μPa^2sec SEL	39.9	0.0045
		Behavioral (all):150 dB re 1 μPa rms	3,981	1.37
Polymeric fender piles	Vibratory	Behavioral (all): 150 dB re 1 μPa rms	15.8	0.001

Note: no injury criteria for fish for vibratory driving; all sound levels expressed in dB re 1 μPa rms. dB=decibel; rms=root-mean-square; μPa=microPascal; Practical spreading loss (15 log, or 4.5 dB per doubling of distance) used for calculations; [1]Sound pressure levels used for calculations are given in Tables 3-12 and 3-13.

The primary cause of injury and mortality to aquatic organisms from pile driving for bulkhead replacement in aquatic environments appears to be damage associated with rupture and hemorrhage of air-filled internal organs, in particular, the swim bladder (Wright and Hopky 1998; Keevin and Hempen 1997), which, in many pelagic fishes, plays a role in buoyancy. Demersal species, such as flounder, typically do not have swim bladders and are frequently less susceptible to pressure impacts. Less information is available, but it is generally reported that there is minimal injury and mortality from pressure to mollusks, shellfish, and crustaceans which do not have gas-filled organs similar to the swim bladder in fish (Wright and Hopky 1998). Although the structure of the swim bladder and the mechanism for adjusting gas volume vary among species, generally the process for release of gas from the swim bladder is too slow to compensate for the rapid fluctuations in hydrostatic pressure associated with the pressure shock wave associated with pile driving. This and other physiological considerations are discussed below (Hempen et al 2005):

> "The primary cause of damage in finfish exposed to a pressure shock wave appears to be the outward rupture of the swim bladder as a result of the expansive effect of the negative hydrostatic pressure associated with the reflected air-water surface wave. While the organ may tolerate the compressive portion of the shock wave, the rapid drop to negative hydrostatic gage pressure and expansion of the gas that cannot otherwise be released, causes the rupture of the organ. Vibration, expansion, and rupture of the swim bladder can also cause secondary damage and hemorrhage due to impact with other internal organs in close proximity to the swim bladder. Other organs typically exhibiting damage include the kidney, liver, spleen, and sinus venosus (a structure in the heart). Extensive tearing of tissue has been observed in species where the swim bladder is closely attached to the visceral cavity. Close attachment to the dorsal cavity wall was typically associated with extensive damage to the kidney. Species

with thick-walled swim bladders and cylindrical body shape (e.g., oyster toad fish and catfish) appear to be more resistant to pressure waves than species with laterally compressed bodies such as herring and menhaden (Linton *et al.* 1985, as cited in Keevin and Hempen 1997). Smaller individuals of a species are generally more sensitive than larger fish. Early-stage larvae do not have swim bladders and are more resistant than older larvae after development of the swim bladder. The extent of injury and mortality decreases with distance from the detonation, as the magnitude of the pressure drop declines due to dissipation of the blast impulse (*I*) and energy flux density (*Ef*) with distance. In a review of a number of studies of primarily open water blasting, Keevin and Hempen (1997) concluded that *I* was the best predictor of potential damage for shallow depths (less than 3 m), while *Ef* was the best predictor for deeper conditions.

4 PROPOSED MITIGATION

Mitigation includes those measures and features that avoid, minimize and/or compensate for unavoidable environmental impacts. For dredging of the Hudson's berth, mitigation includes endangered species protection on the dredge by compliance with the USACE/FWS standard manatee construction protocols and compliance with the NMFS sea turtle and smalltooth sawfish construction protocols. For bulkhead replacement mitigation includes relocation of scleractinian corals greater than 10 cm in diameter from the bulkhead to an alternative location and monitoring for marine mammal presence during bulkhead construction operations with appropriate shutdown criteria should dolphins or manatees approach within 130 feet of the construction area. Compensatory mitigation for unavoidable impacts to seagrasses is planned to occur at the Julia Tuttle Mitigation Area and will consist of planting of up to one-half (0.5) acre of the site not previously scheduled for seagrass planting under any other project's mitigation requirements. Additionally, monitoring of turbidity during dredging (and bulkhead work if elevated turbidity levels are observed) will comply with the appropriate water quality standards. This determination is in compliance with 403.813, Florida Statutes and 404(f) of the Clean Water Act.

5 EFFECTS DETERMINATION

The USCG has determined that maintenance dredging of the USCG Cutter Hudson's slip will result in the permanent removal of 0.13 acres of seagrass from the previously dredged slip and a subset of the 197 stony corals greater than 10cm in size which are located on Zones 4 and 5 of the bulkhead. Minimal impacts to fishes is expected by hydraulic dredging and minimal impact to fish species in Melloy Channel are expected by replacement of the bulkheads in Zones 4 and 5.

LITERATURE CITED

FHWG (Fisheries Hydroacoustic Working Group). 2008. Memorandum of agreement in principle for interim criteria for injury to fish from pile driving. California Department of Transportation (CALTRANS) in coordination with the Federal Highway Administration (FHWA). http://www.wsdot.wa.gov/NR/rdonlyres/4019ED62-B403-489C-AF05F4713D663C9/0/InterimCriteriaAgreement.pdf

Hastings, M. C. & Popper, A. N. (2005). *Effects of sound on fish*. Report to California Department of Transportation. pp. 1-82.

Hempen, G. L., T. M. Keevin, and H. J. Reuben. 2005. Underwater blast pressures from confined rock removal shots: The Kill Van Kull Deepening Project. Pp. 91-100. In *Proceedings of the Thirty-first Annual Conference on Explosives and Blasting Technique*, Orlando, Florida. International Society of Explosive Engineers, Cleveland, OH.

Hoffmeister, J.E., K.W. Stockman, and H.G. Multer. 1967. Miami limestone of Florida and its recent Bahamian counterpart. Geological Society of America Bulletin. 78:175-190.

Illingworth & Rodkin, Inc. (2001). *Noise and Vibration Measurements Associated with the Pile Installation Demonstration Project for the San Francisco-Oakland Bay Bridge East Span, Chapter 4*. Prepared by Illingworth and Rodkin, Petaluma, CA. Prepared for the California Department of Transportation, Sacramento, CA.

Jaap, W.C., 1984. The ecology of the south Florida coral reefs: a community profile. FWS OBS-82/08 and MMS 84-0038. 138 pp.

Keevin, T.M., and G.L. Hempen. 1997. The environmental effects of underwater explosions with methods to mitigate impacts. U.S. Army Corps of Engineers St. Louis District, St. Louis, Missouri.

Porter, J.W., 1987. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (south Florida) - reef-building corals. U.S. Fish and Wildlife. Service Biological Report, 82(11.73), pp. 1-23.

Settle, L. 2003. NOAA/NOS National Centers for Coastal Ocean Science. Assessment of potential larval entrainment mortality to hydraulic dredging of Beaufort Inlet. Assessment prepared for USACE-Wilmington District for the Morehead City Harbor Environmental Assessment.

South Atlantic Fishery Management Council (SAFMC). 1998. Final Comprehensive Amendment Addressing Essential Fish Habitat in Fishery Management Plans of the South Atlantic Region. Charleston, SC. 142 pp. Available on-line: http://www.safmc.net/Default.aspx?tabid=80

U.S Army Corps of Engineers (USACE) 1989. Navigation Study for Miami Harbor Channel, FL. Feasibility Report and Environmental Impact Statement – 10140.

Wright, D.G. and G.E. Hopky 1998. Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters. Canadian Technical Report of Fisheries and Aquatic Sciences 2107: pp.43.

This page intentionally left blank

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Regional Office
263 13th Avenue South
St. Petersburg, Florida 33701-5505
http://sero.nmfs.noaa.gov

July 18, 2014 F/SER4:JK/pw

(Sent via Electronic Mail)

Colonel Alan Dodd, Commander
U.S. Army Corps of Engineers, Jacksonville District
PO Box 4970
Jacksonville, Florida 32232

Attention: Terri Jordan-Sellers

Dear Colonel Dodd:

NOAA's National Marine Fisheries Service (NMFS) reviewed the essential fish habitat (EFH) assessment prepared by the Jacksonville District for the maintenance dredging of one berth and the replacement of two sections of bulkhead along the eastern and southern sides of U.S. Coast Guard (USCG) Station Miami Beach, located in Biscayne Bay and north of the main entrance to the Port of Miami. The EFH assessment was provided to NMFS by letter dated June 17, 2014, which also indicated the Jacksonville District is serving as USCG's agent for the EFH consultation. The District's and USCG's initial determination is the proposed work may adversely affect EFH, including an unspecified number of corals and 0.13 acres of seagrass, which the South Atlantic Fishery Management Council (SAFMC) designated Habitat Areas of Particular Concern (HAPCs). As the nation's federal trustee for the conservation and management of marine, estuarine, and anadromous fishery resources, the following comments and recommendations are provided pursuant to authorities of the Fish and Wildlife Coordination Act and the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act).

Description of the Proposed Action

The proposed maintenance dredging to a depth of -8 feet mean lower low water (MLLW), plus two feet of allowable overdredge, is expected to require removal of no more than 5,000 cubic yards of material. The berth is 85 feet wide and 300 feet long (0.59 acres) and was last dredged in 1995. The dredged material would be transported to the Miami Ocean Dredged Material Disposal Site (ODMDS) 3.6 miles southeast of the Port of Miami entrance channel[1]. Approximately 1,261 linear feet of bulkhead is scheduled for replacement in areas referred to as Zone 4 and Zone 5. Water depths at Zone 5 range from 8 to 22 feet, and depths at Zone 4 range from 4 to 8 feet. The new bulkhead would be constructed waterward of the existing bulkhead, which would remain in place and become part of the backfill. How far waterward is not clear from the EFH assessment. NMFS presumes the new bulkhead would be adjacent to the old bulkhead because no filling is described. If this is not the case, NMFS reinitiation of the EFH consultation may be necessary.

Description of EFH in the Project Area

The EFH assessment presents results from biological surveys conducted May 28 to 30, 2013, and June 12, 2013. Approximately 0.42 acres of seagrass were documented within and adjacent to the berth, including 0.13 acres within the dredging footprint and side-slope areas. The species present include paddle grass (*Halophila decipiens*), shoal grass (*Syringodium filiforme*), and turtle grass (*Thalassia testudinum*). The

[1] The EFH assessment does not examine the suitability of the material for disposal in the Miami ODMDS.

remainder of the bay bottom is sand with rock rubble and man-made debris (e.g., tires) close to the bulkhead.

The coral surveys documented 580 scleractinian corals on the station bulkheads. The number of corals on the bulkheads scheduled for replacement cannot be determined with the information provided. The corals along the entire bulkhead are represented by 18 species, and the survey report notes 197 of the 580 corals are larger than 10 centimeters in diameter. Octocorals were not enumerated in the survey. Additional corals were noted on boulders and debris at the base of the north, east, and south walls and not enumerated.

Essential Fish Habitat within the Project Area
The project area includes seagrass and coral. The South Atlantic Fishery Management Council (SAFMC) designates seagrass as EFH. Federally managed fishery species associated with seagrass and present in the project area include various life stages of gray, mutton, lane and schoolmaster snappers; white grunt; and brown and pink shrimp. All demersal fish species under SAFMC management associated with coral habitats are contained within the fishery management plan for the snapper-grouper complex and include some of the more commercially and recreationally valuable fish of the region. All of these species show an association with coral or hardbottom habitat during their life history. In grouper, the demersal life history of almost all *Epinephelus* species, several *Mycteroperca* species, and all *Centropristis* species takes place in association with coral habitat. Coral, coral reef, and hardbottom habitats benefit fishery resources by providing food or shelter.

SAFMC also designates seagrass and coral as HAPCs, which are subsets of EFH that are either rare, particularly susceptible to human-induced degradation, especially important ecologically, or located in an environmentally stressed area. All of Biscayne Bay is a HAPC for spiny lobster and for coral, coral reefs, and hardbottom. Additionally, the project is sited within the Biscayne Bay Aquatic Preserve, which is a state-designated nursery area and also a HAPC. Seagrass and coral directly benefit the fishery resources of Biscayne Bay by providing nursery and shelter habitat. Seagrass and coral are also part of a habitat complex that includes mangrove and hardbottom habitats, and this complex supports a diverse community of fish and invertebrates within Biscayne Bay. Seagrass also provide important water quality maintenance functions (such as pollution uptake), stabilize sediments, attenuate waves, and produce and export detritus (decaying organic material), which is an important component of marine and estuarine food chains. SAFMC provides additional information on EFH and HAPCs and how they support federally managed fishery species in *Fishery Ecosystem Plan of the South Atlantic Region*, which is available at *www.safmc.net*.

Minimization of Impacts to Corals through Coral Relocation
Prior to dredging and replacing the bulkhead, USCG will transplant healthy stony corals greater than 10 centimeters[2] in diameter that can be removed without breaking the colony, do not show bleaching symptoms, and are not colonized by boring sponges. The removed corals will be relocated to an approved artificial reef site managed by Miami-Dade County or the Port of Miami or given to the Miami Natural History Museum for educational purposes.

Generally, corals greater than or equal to 5 centimeters in diameter can be successfully relocated. Brownlee (2010) successfully transplanted small coral (*Siderastrea siderea, Dichocoenia stokesii,* and

[2] Section 1.2 (page 10) refers to 10 inches as the minimum size class for relocation, however this is presumed to be a typographical error because Section 1.2 (page 11), Section 2.2 (page 30), Section 3.3.2 (page 33), and Section 4 (page 36) refer to 10 centimeters as the minimum size class for relocation.

Porites porites) with greater than 80 percent survivorship after 13 months (the study duration). Monty et al. (2006) successfully transplanted 250 corals (14 species) ranging from 5 to 40 centimeters in diameter with a high rate of survivorship. These corals also were monitored for 13 months. Eight species had 100 percent survivorship, including 78 *Siderastrea siderea*. Thornton et al. (2000) transplanted 271 corals from an outfall pipe in Broward County to an articulated concrete mat. *Siderastrea siderea* comprised 90 percent of the corals <1 to 100 square centimeters in size. After 27 months, 266 of the corals had survived (87 percent), as compared to 83 percent survival for corals on the nearby natural substrate. In addition, Stephens (2007) salvaged coral from a coastal construction impact site in Broward County and 92 to 100% of the transplants survived after 18 to 24 months.

NMFS requests the District provide a coral relocation plan. The plan should include information on the suitability of the receiving sites based on water depths, physical conditions, and threats from development. The coral relocation plan should describe relocation of all scleractinian corals greater than or equal to 10 centimeters in diameter and relocation of octocorals from the genera *Gorgonia, Eunicea, Plexaura, Plexaurella, Muricea,* and *Pterogorgia*. NMFS would support efforts to relocate scleractinian corals smaller than 10 centimeters in diameter. The coral relocation plan should also provide the methods for the relocation, monitoring of the relocated corals for a period of three years, and assessment of relocation success with respect to acceptable performance measures.

Other Minimization Measures to Minimize Construction Impacts
NMFS recommends the District and USCG develop best management practices (BMPs) to further minimize construction related impacts. These BMPs should include use of staked turbidity curtains and prohibiting dredge vessels from spudding or anchoring in seagrass areas. NMFS also would support removal of the debris noted in the biological survey.

Compensatory Mitigation
Compensatory mitigation for unavoidable impacts to seagrass is planned to occur at the Julia Tuttle Mitigation Area and would consist of planting of up to 0.5 acres of seagrass at locations not already scheduled for seagrass planting under another project's mitigation requirement. NMFS recommends the District prepare a compensatory mitigation plan for the seagrass impacts. The plan should include results from a functional analysis using the Unified Mitigation Assessment Method (or similar method) to show seagrass mitigation amounts would adequately offset seagrass impacts. Additional information on planting is needed, including identification and methods to obtain donor seagrass, methods for planting, biological monitoring schedule and methods, locations of the planting area, and performance standards. NMFS also recommends the compensatory mitigation plan address the unavoidable impacts to corals (i.e., scleractinian corals and octocorals not relocated or killed during relocation).

Conservation Recommendations
NMFS finds the proposed maintenance dredging and bulkhead replacement would adversely impact EFH. Section 305(b)(4)(A) of the Magnuson-Stevens Act requires NMFS to provide EFH conservation recommendations when an activity is expected to adversely impact EFH. Based on this requirement, NMFS provides the following:

EFH Conservation Recommendations

1. The project shall include a compensatory mitigation plan describing how seagrass and coral impacts will be appropriately offset. NMFS recommendations for the plan contents are listed above.

2. The project shall include a coral relocation plan that, at a minimum, describes relocation of scleractininan corals greater than or equal to 10 centimeters in diameter and octocorals from the genera *Gorgonia, Eunicea, Plexaura, Plexaurella, Muricea,* and *Pterogorgia*. The plan shall describe the suitability of the receiving site in terms of water depths and physical conditions similar to those at the removal site and the absence of threats from development. The coral relocation plan shall describe methods for the relocation, monitoring of the relocated corals for a period of three years, and assessment of relocation success with respect to acceptable performance measures.
3. The project shall include best management practices to avoid and minimize impacts to corals and seagrass habitat, including the use of staked turbidity curtains around the work areas and prohibiting staging, anchoring, mooring, and spudding of work barges and other associated vessels over seagrass.

Section 305(b)(4)(B) of the Magnuson-Stevens Act and implementing regulation at 50 CFR Section 600.920(k) require the Jacksonville District and USCG to provide a written response to this letter within 30 days of its receipt. If it is not possible to provide a substantive response within 30 days, an interim response should be provided to NMFS. A detailed response then must be provided prior to final approval of the action. The detailed response must include a description of measures proposed by the Jacksonville District and USCG to avoid, mitigate, or offset the adverse impacts of the activity. If the response is inconsistent with the EFH conservation recommendation, a substantive discussion justifying the reasons for not following the recommendation must be provided.

Thank you for the opportunity to provide comments. Related questions or comments should be directed to the attention of Ms. Jocelyn Karazsia at 400 North Congress Avenue, Suite 110, West Palm Beach, Florida, 33401. She may be reached by telephone at 561-249-1925 or by e-mail at Jocelyn.Karazsia@noaa.gov.

Sincerely,

Pace Wilber

/ for

Virginia M. Fay
Assistant Regional Administrator
Habitat Conservation Division

cc:

USCG, Andrew.L.Bobick@uscg.mil, George.F.Hall@USCG.Mil
CESAJ, Terri.Jordan-Sellers@usace.rmy.mil
FWS, Jeffrey_Howe@fws.gov
FWCC, Lisa.Gregg@MyFWC.com, Erin.McDevitt@MyFWC.com
FDEP, Vladimir.Kosmynin@dep.state.fl.us
EPA, Miedema.Ron@epa.gov
SAFMC, Roger.Pugliese@safmc.net
F/SER3, Kel.Logan@noaa.gov
F/SER4, David.Dale@noaa.gov
F/SER47, Jocelyn.Karazsia@noaa.gov

Works Cited

Brownlee, A.S. 2010. Transplantation and parrotfish predation: A study on small *Siderastrea siderea* offshore Broward County, FL USA. Master's Thesis. NOVA Southeastern University Oceanographic Center.

Monty, J.A., Gilliam, D.S., Banks, K.W., Stout, D.K., and Dodge R.E. 2006. Coral of opportunity survivorship and the use of coral nurseries in coral reef restoration. Proceedings to the 10th International Coral Reef Symposium, pages 1665–1673.

Stephens, N.R. 2007. Stony coral transplantation associated with coastal and marine construction activities. Master's Thesis submitted to Nova Southeastern University Oceanographic Center. 75 pp.

Thornton S.L., Dodge, R.E., Gilliam, D.S., DeVictor, R., and Cook, P. 2000. Success and growth of corals transplanted to concrete armor mat tiles in southeast Florida: Implications for reef restoration. Proceedings to the 9th International Coral Reef Symposium Volume 2:23–27.

This page intentionally left blank

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
P.O. BOX 4970
JACKSONVILLE, FLORIDA 32232-0019

REPLY TO
ATTENTION OF

Planning and Policy Division
Environmental Branch

AUG 12 2014

Ms. Virginia Fay,
Assistant Regional Administrator
Habitat Conservation Division
National Marine Fisheries Service
263 13th Avenue South
St. Petersburg, Florida 33701-5505

Dear Ms. Fay:

The U.S. Coast Guard, (USCG) has received your letter dated July 18, 2014 providing Essential Fish Habitat (EFH) Conservation Recommendations for the maintenance dredge and bulkhead replacement at U.S. Coast Guard Station Miami Beach, Miami-Dade County, Florida. For your information and awareness, the Jacksonville District of the Corps of Engineers is serving as the US Coast Guard's agent for this consultation. As such, we prepared the Essential Fish Habitat Assessment prepared for the project which was submitted to your office on June 17, 2014.

Detailed responses to the three Essential Fish Habitat Conservation Recommendations provided by the July 19, 2014 letter are included below. Based on the enclosed responses, the USCG is satisfied that the consultation procedures outlined in 50 CFR Section 600.920 of the regulation to implement the EFH provisions of the Magnuson-Stevens Act have been met.

Response to the Essential Fish Habitat (EFH) Conservation Recommendations

1. The project shall include a compensatory mitigation plan describing how seagrass and coral impacts will be appropriately offset. NMFS recommendations for the plan contents are listed above.

> NMFS' letter includes recommendations for a mitigation plan for seagrass "*...include results from a functional analysis using the Unified Mitigation Assessment Method (or similar method) to show seagrass mitigation amounts would adequately offset seagrass impacts. Additional information on planting is needed, including identification and methods to obtain donor seagrass, methods for planting, biological monitoring schedule and methods, locations of the planting area, and performance standards.*"

At the request of Miami-Dade County DERM, Coast Guard plans to "piggyback" the mitigation for the unavoidable impacts to seagrasses which have colonized the previously dredged slip by adding additional seagrass plantings to the previously approved and permitted seagrass restoration site for the Miami Harbor expansion project. NMFS has previously reviewed the proposed Miami Harbor mitigation area and mitigation plan as part of the Miami Harbor expansion project (NMFS EFH Consultation completed in February 2004). In summary, the Miami Harbor seagrass mitigation is being conducted north of the Julia Tuttle Causeway in a dredge hole that is more than 80 years old. Approximately 31 acres of the dredge hole is available to be filled with dredged material and capped with select fill to create no less than 16.6 acres of habitat, plus up to an additional two acres of overbuild, within the mitigation area at an elevation -4 MLLW plus/minus 0.5 ft. Upon acceptance of the Julia Tuttle Mitigation Site (JTMS) filling by the COTR, the JTMS will be planted in accordance with the FDEP permit using the following Harvest and Planting Plan (Plan). This Plan includes estimates of harvest area extent, approximate locations, handling methodology, quality control (QC) protocols, and analysis. All seagrass harvesting activities will be conducted in compliance with the U.S. Army Corps of Engineers approved dive plan and Accident Prevention Plan, and off survey vessels will an absolute minimum clearance of 1 foot over any seagrass communities, and by qualified, experienced marine scientists. As part the seagrass mitigation and planting specifications, 7.15 acres of the 14.3 acres JTMS must be planted with *Syringodium filiforme* at a density of one Planting Unit (PU) per square meter (1 PU/m2) with each PU consisting of 5 apical rhizomes using the bare root method (this can include either "aerial runners" or below-ground apical rhizomes). The total number of PUs required is estimated to be 29,000, requiring nearly 145,000 individual apical meristems. Based on initial estimates, densities of apical rhizomes surrounding the JTMS range from 35/m2 ("aerial runners") to 95/m2 (below-ground apicals), or 120 total apicals/m2. Based on this, a total donor area of approximately 1,100 to 4,000 m2 will be required, depending on which material type is used ("aerial runners", below-ground apicals, or a combination of both) and their density at the time of harvest

Utilizing the Miami Harbor plan for the JTMS, USCG will plant up to an additional 0.5 acres of seagrass in the 2.3 acres of the JTMS not currently scheduled for seagrass planting under the Miami Harbor plan. This value was determined by a UMAM conducted by USCG and reviewed by USACE-Regulatory Division Miami Office staff. The UMAM determined that 0.3 acres of seagrass mitigation was required to offset the unavoidable impacts. To fully benefit from economies of scale, the additional seagrass planting at the JTMS site will be conducted by the same contractor conducting the Miami Harbor mitigation. The USCG site will be separated from the Miami site, so that they can be monitored separately. Post planting monitoring will include a 30-day post planting monitoring, remedial planting as required and five-annual monitoring events.

Additionally NMFS requests that a mitigation plan for unavoidable impacts to corals remaining on the bulkhead be included in the plan. USCG does not plan to mitigate for corals left on the bulkhead after coral relocation efforts are complete, as the new bulkhead will offer significant open hard habitat for new corals to attach to and as such, the replacement of the bulkhead is self-mitigating.

2. The project shall include a coral relocation plan that, at a minimum, describes relocation of scleractininan corals greater than or equal to 10 centimeters in diameter and octocorals from the genera *Gorgonia, Eunicea, Plexaura, Plexaurella, Muricea,* and *Pterogorgia*. The plan shall describe the suitability of the receiving site in terms of water depths and physical conditions similar to those at the removal site and the absence of threats from development. The coral relocation plan shall describe methods for the relocation, monitoring of the relocated corals for a period of three years, and assessment of relocation success with respect to acceptable performance measures.

> USCG coordinated with DERM and determined there is not sufficient space on the one in-water coral artificial reef within Biscayne Bay to absorb the corals proposed for relocation from the USCG bulkhead. Additionally, the Port of Miami stated they would prefer corals from USCG not be relocated to their rip-rap areas to ensure room remains for future relocations which may be required for port projects. USCG does not plan to construct an in-water artificial reef in Biscayne Bay to absorb these corals. Instead we have coordinated with the Miami Science Center to come to USCG Station Miami Beach and collect corals, soft corals and sponges from the bulkheads for use in their new aquarium and in coral culture at their facility.

3. The project shall include best management practices to avoid and minimize impacts to corals and seagrass habitat, including the use of staked turbidity curtains around the work areas and prohibiting staging, anchoring, mooring, and spudding of work barges and other associated vessels over seagrass.

> The project will use Best Management Practices to avoid and minimize impacts to corals and seagrass habitat, however, due to the speed of the currents in the Melloy channel, use of staked turbidity curtains around the work areas is not a viable option. The plans and specifications for the project will include a prohibition on staging, anchoring, mooring, and spudding of work barges and other associated vessels over seagrass.

This completes the USCG's requirements for EFH consultation under the Magnuson-Stevens Act. In accordance with the previously cited regulations and finding, no further action is required by the USCG unless NMFS-HCD plans to elevate to the Department of Army Headquarters in accordance with 50 CFR 600.9200)(2).

The POC is Mrs. Terri Jordan-Sellers, 701 San Marco Blvd, Jacksonville FL 32207, telephone 904-232-1817, Terri.Jordan-Sellers@usace.army.mil.

Sincerely

Eric P. Summa
Chief, Environmental Branch
Planning and Policy Division

FLORIDA DEPARTMENT *of* STATE

RICK SCOTT
Governor

KEN DETZNER
Secretary of State

November 26, 2013

Mr. Eric Summa
Planning and Policy Division
Jacksonville Corps of Engineers
Post Office Box 4970
Jacksonville, Florida 32232-0019

Re: DHR Project File No.: 2013-05232/ Received: November 4, 2013
UGCG *Cutter Hudson* Maintenance Dredge
County: Miami-Dade

Dear Mr. Summa,

Our office received and reviewed the project in accordance with Section 106 of the National Historic Preservation Act of 1966, as amended and 36 CFR Part 800. The State Historic Preservation Officer is to advise and assist federal agencies when identifying historic properties (archaeological, architectural, and historical resources) listed, or eligible for listing, in the National Register of Historic Places, assessing the project's effects, and considering alternatives to avoid or minimize adverse effects.

Based on the information provided, this office concurs that the proposed project will have no adverse effect on historic or archaeological properties.

If you have any questions concerning our comments, please contact Michael Hart, Historic Sites Specialist, by phone at 850.245.6333, or by electronic mail at Michael.Hart@dos.myflorida.com. Your continued interest in protecting Florida's historic properties is appreciated.

Sincerely

Robert F. Bendus, Director
Division of Historical Resources
and State Historic Preservation Officer

This page intentionally left blank

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
P.O. BOX 4970
JACKSONVILLE, FLORIDA 32232-0019

REPLY TO
ATTENTION OF

JUN 2 3 2014

Planning and Policy Division
Environmental Branch

Mr. Robert Bendus
Division of Historical Resources.
State Historic Preservation Officer
500 South Bronough Street
Tallahassee, Florida 32399-0250

Dear Mr. Bendus:

The U.S. Army Corps of Engineers (Corps), Jacksonville District, is proposing to replace the bulkheads along the eastern and southern side of the US Coast Guard Station Miami Beach, Miami, Florida. The USCG Miami Beach is located on a man-made island, on the south side of Melloy Channel and north of the main entrance to the Port of Miami, Government Cut, in Dade County, Florida (Figure 1).

The Coast Guard uses areas along the bulkhead to moor and support Coast Guard Cutters. Sections of bulkhead have reached the end of their service life such that vehicle loading is restricted on the shore side which impacts the operations of the Cutters. Holes in the current sheet pile bulkhead have caused retained soil to escape causing sink holes to form along the edge of the bulkhead and if not replaced, the bulkhead will no longer be an operational area for the Coast Guard Cutters.

The current bulkhead surrounding USCG Miami Beach is steel sheet pile with a concrete cap, which retains the soil backfill around the entire, man-made island, constructed in the 1940's. Additional areas were built out in the 1960's and some sections were replaced in the 1980's. Approximately 1,261 linear feet of bulkhead along the east and south section of the island is scheduled for replacement (Figure 2).

Replacement of the bulkheads will involve the building-out of new bulkheads from the existing bulkhead, while leaving the old bulkhead in place to become part of the backfill. No other structures or elements at USCG Miami Beach that would make this property eligible for the National Register of Historic Places will be impacted by the construction of the new bulkheads. Replacing the bulkhead is an in-kind update and will not change any of the visual or functional aspects of the USCG Miami Beach property.

The Corps has determined no historic properties affected for the bulkhead replacement at USCG Miami Beach Station. I request your concurrence on my determination. If there are any questions, please contact Ms. Wendy Weaver at 904-232-2137 or e-mail at wendy.weaver@usace.army.mil.

Sincerely,

Eric P. Summa
Chief, Environmental Branch

Weaver/CESAJ-PD-EP
Hughes/CESAJ-PD-EP
Acosta/CESAJ-PD-EP
Summa/CESAJ-PD-E

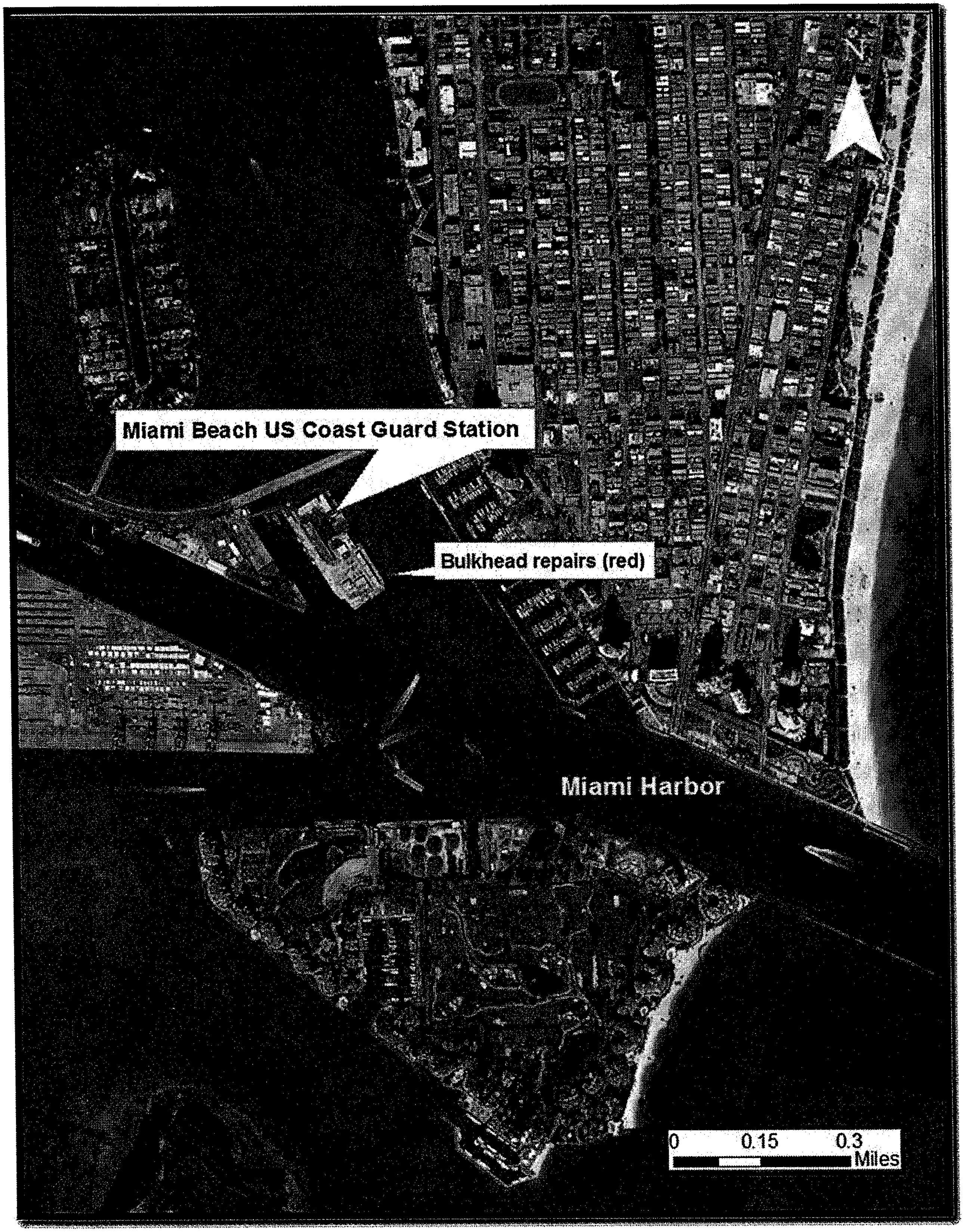


Figure 1. USCG Miami Beach and location of bulkhead repairs.

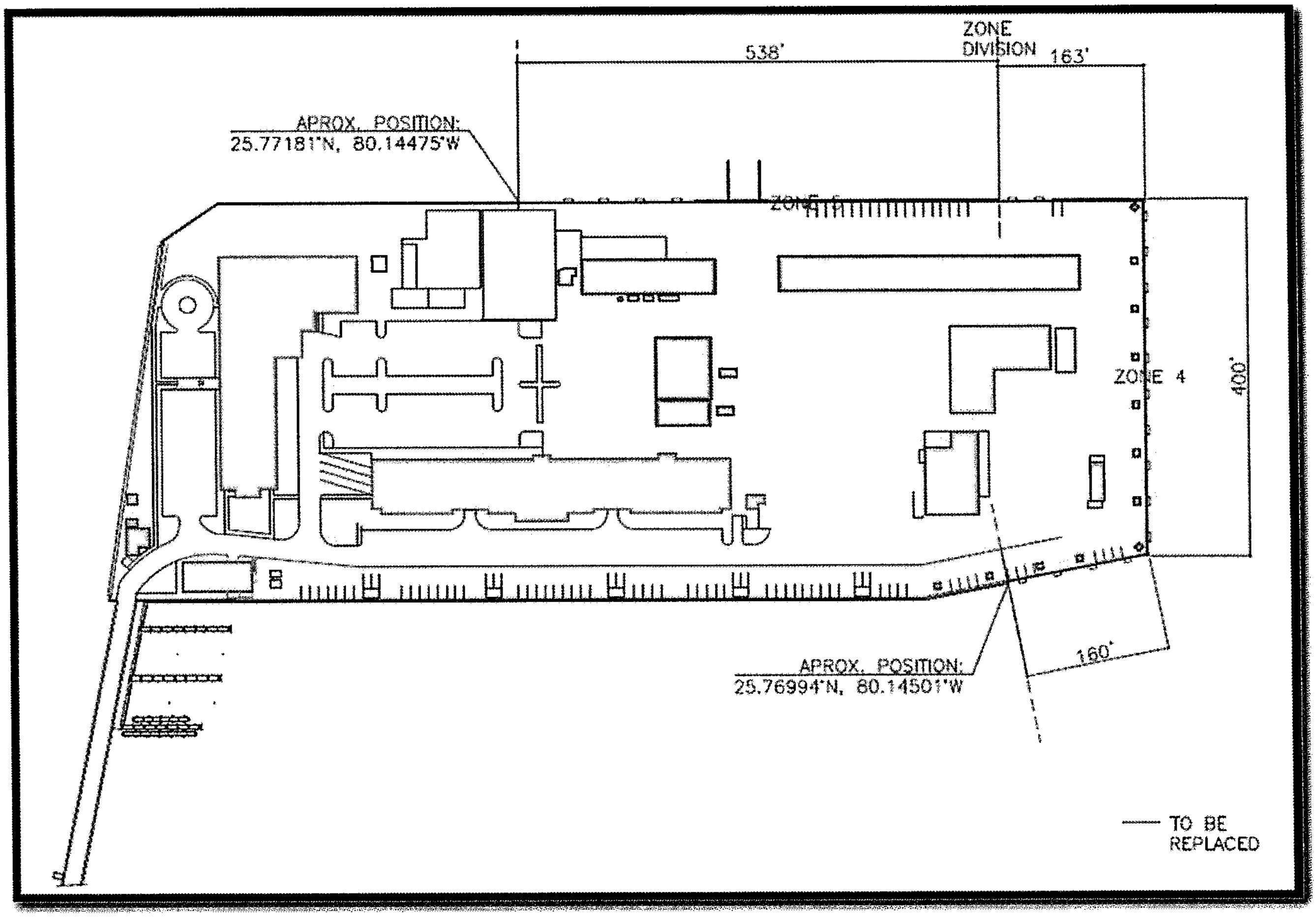


Figure 2. Plan Sketch of USCG Miami Beach with locations of bulkheads to be replaced.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA FEDERAL CENTER
61 FORSYTH STREET
ATLANTA, GEORGIA 30303-8960

Eric Summa, Chief
Environmental Branch
Planning Division
Jacksonville District Corps of Engineers
P.O. Box 4970
Jacksonville, FL 32232-0019

Dear Mr. Summa:

This letter is in regard to your November 4, 2014, request for concurrence for ocean disposal of material from the Meloy channel at the U.S. Coast Guard Station, Miami-Dade County, Florida pursuant to Section 103 of the Marine Protection, Research and Sanctuaries Act of 1972. The project considered for ocean disposal consists of 450 to 1150 cubic yards of maintenance material from Meloy Channel north of Miami Harbor. Project depth is -8 feet MLLW with an allowable overdepth of 1 foot. The material has been characterized as sand. This project was also noticed under a public notice issued on December 5, 2014 (SAJ-1992-31007) as a permit will have to be issued to the U.S. Coast Guard. Disposal of the material is proposed for the Miami Ocean Dredged Material Disposal Site (ODMDS) and will be dredged under the same contract as the ongoing deepening project at the Port of Miami.

The Environmental Protection Agency (EPA) has reviewed the Tier I Section 103 Evaluation Report submitted with your letter which included draft permit conditions. Material from Meloy Channel was sampled in April 2013. Two samples were analyzed and material was classified as sand with less than 5% fines. Current data collected adjacent to Fisherman's Island Turning Basin showed average currents in excess of 30cm/sec. This material is composed predominately of sand and is found in areas of high current and therefore meets the criteria in 40 CFR 227.13(b)(1) and is acceptable for ocean disposal without further testing.

EPA has also reviewed the proposed permit conditions and found them consistent with the Miami ODMDS Site Management and Monitoring Plan (SMMP), with the exception of a requirement for disposal vessels to remain within the channel until east of the buoy G"1." Section 104 of the MPRSA requires that Section 103 permits be conditioned consistent with the requirements of the approved SMMP. This concurrence is therefore conditional upon implementation of this additional permit condition and is valid for a period of three years from the date of this letter. If you have any questions regarding this determination or management of the Miami ODMDS, please contact Mr. Chris McArthur at (404) 562-9391.

Sincerely,

Thomas McGill, Chief
Oceans, Wetlands, and Stream Protection Branch
Water Protection Division

cc: Megan Clouser, USACE South Permits Section (electronic)

This page intentionally left blank

Mailing List – USCG Miami Beach HUDSON Dredging and Bulkhead Replacement

Sent by Email or hard copy as appropriate

Federal Agencies

EPA, Region IV

Beth Walls – Walls.Beth@epamail.epa.gov

Heinz Mueller - Mueller.Heinz@epamail.epa.gov

Chris McArthur - mcarthur.christopher@epa.gov

Ron Miedema - Miedema.Ron@epamail.epa.gov

USFWS – Vero Beach

Jeff Howe - Jeffrey_Howe@fws.gov

NMFS – SE Region

Pace Wilbur - Pace.Wilber@noaa.gov

Jocelyn Karazsia - Jocelyn.Karazsia@noaa.gov

Kay Davy - kay.davy@noaa.gov

State Agencies

FLDEP State Clearinghouse

Lauren Milligan - lauren.milligan@dep.state.fl.us

FLDEP – CAMA – Biscayne Bay AP

Pamela Sweeney - Pamela.Sweeney@dep.state.fl.us

FLDEP Southeast Region

Kelly Egan – Kelly.Egan@dep.state.fl.us

Florida Fish and Wildlife Conservation Commission

Mary Duncan - mary.duncan@myfwc.com

Robbin Trindell – ROBBIN.TRINDELL@myfwc.com

Scott Sanders – Scott.Sanders@myfwc.com

Dr Janet Matthews
Div of Historical Resources - SHPO
500 South Bronough St
Tallahassee, FL 32399 0250

City/County Agencies

Miami-Dade DERM
Sara Thanner - ThannS@miamidade.gov
Steve Blair - BlairS@miamidade.gov

Miami Beach
Mayor, City of Miami Beach
1700 Convention Center Dr
Miami Beach, FL 33139

Betsy Wheaton – ElizabethWheaton@miamibeachfl.gov

Private Groups or Individuals

Director, Tropical Audubon Society - director@tropicalaudubon.org
Director, Biscayne Bay Keeper - rachel@bbwk.org
The Nature Conservancy - jbyrne@tnc.org
Miami Science Center – duricchio@miamisci.org
Sea Turtle Conservancy – stc@conserveturtles.org
Reefkeeper International – reefkeeper@reefkeeper.org